SELECTED

SWATERRESOURCES ABSTRACTS



VOLUME 22, NUMBER 3 MARCH 1989

W89-02287 -- W89-03334 CODEN: SWRABW **S** ELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Geological Survey, U.S. Department of the Interior, and published monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey U.S. Department of the Interior

VOLUME 22, NUMBER 3 MARCH 1989

W89-02287 -- W89-03334



The Secretary of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 1989.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

S elected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the Water Resources Thesaurus. The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific Information Center U.S. Geological Survey MS 425 National Center Reston, VA 22092

CONTENTS

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes: Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

FIELD STUDY OF EPHEMERAL STREAM-AQUIFER INTERACTION, New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience. For primary bibliographic entry see Field 2F. W89-02349

EPHEMERAL RUNOFF AND GROUNDWAT-ER RECHARGE,
New Mexico Univ., Albuquerque. Dept. of Civil

For primary bibliographic entry see Field 2F. W89-02350

HYDROLOGY IN PRACTICE, Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering. E. M. Shaw.

Van Nostrand Reinhold (International) Co. Ltd., London. 1988. 539p. 2nd ed.

Descriptors: *Textbooks, *Surface-water hydrology, *Hydrology, Hydrologic cycle, Hydrometeorology, River flow, Engineering, Stochastic hydrology, Soil water, Groundwater, Surface water.

The subject of hydrology is presented in a global context; hydrological conditions in the different climatic regions are described; incidences of hyclimatic regions are described; incidences of hydrological extremes are necessarily taken from worldwide situations; and examples of major engineering applications from many countries are noted. Three main aspects of hydrology are conidered: (1) Hydrological measurements (hydrometric networks, precipitation, evaporation, soil moisture, river flow, groundwater, water quality, and data processing); (2) hydrological analysis (precipitation analysis, evaporation calculations, river flow analysis, rainfall-runoff relationships, catchment modelling, and stochastic hydrology; and (3) engineering applications (flood routing, design floods, urban hydrology, water resources, and river basin management). (Lantz-PTT)

TECHNIQUES FOR ESTIMATING REGIONAL FLOOD CHARACTERISTICS OF SMALL RURAL WATERSHEDS IN THE PLAINS REGION OF EASTERN COLORADO,

Geological Survey, Denver, CO. Water Resources For primary bibliographic entry see Field 2E. W89-02507

RAINFALL-RUNOFF DATA FOR SOMERSET COUNTY, NEW JERSEY, Geological Survey, Trenton, NJ. Water Resources

For primary bibliographic entry see Field 2E. W89-02592

HYDROLOGY OF THE WHITE TAIL BUTTE AREA, NORTHERN CAMPBELL COUNTY, WYOMING, Geological Survey, Cheyenne, WY. Water Re-

For primary bibliographic entry see Field 4C. W89-02596

EFFECTS OF IRRIGATION PRACTICES ON STREAM-CONNECTED PHREATIC AQUIFER

STREAM-CONNECTED PHREATIC AQUIFER SYSTEMS,
Oklahoma Univ., Norman. Dept. of Civil Engineering and Environmental Science.
For primary bibliographic entry see Field 3F.
W89-02661

HYDROLOGY 2000. International Association of Hydrological Sciences, Inst. of Hydrology, Wallingford, England.

IAHS Publication No. 171, 1987. 100p. Report of the HYDROLOGY 2000 Working Group of the International Association of Hydrological Sci-ences. Edited by Zbigniew W. Kundzewicz, Lars Gottschalk, and Bruce Webb.

Descriptors: *Hydrologic studies, *Future planning, Water quality, Surface water, Groundwater, Snow, Ice, Water resources, Erosion, Sedimentation, Mathematical models, Data acquisition, Hydrology 2000

The HYDROLOGY 2000 Working group was initiated during the International Association of Hydrological Sciences (IAHS) Assembly within the International Union of Geodesy and Geophysics General Assembly held in Hamburg in August 1983. Under Resolution 2/2, the Hamburg Assembly 1983. Under Resolution 2/2, the Hamburg Assembly agreed to the establishment of a Working Group of young hydrologists, to consider and report on the prospects for hydrology until the end of the twentieth century. This report consists of 10 chapters, an introductory chapter on hydrological sciences in perspective, and contributions corresponding to the division of 1AHS into its constituent Commissions. The chapters cover perspectives of research into surface water, groundwater, water quality, snow and ice, erosion and sedimentation, water resources systems, perspectives on mathematical modelling, data acquisition, and hydrology and hydrologists. Most of the chapters are arranged to discuss trends, barriers to progress in the subject subarea, and perspectives on future development up to the time horizon of the year 2000. (See W89-02718 thru W89-02727) (Lantz-PTT) The HYDROLOGY 2000 Working group was

HYDROLOGICAL SCIENCES IN PERSPEC-

TIVE, Polish Academy of Sciences, Warsaw. Inst. of

Geophysics.

Z. W. Kundzewicz, L. Gottschalk, and B. Webb.

IN: Hydrology 2000. International Association of
Hydrological Sciences, Inst. of Hydrology, Wallingford, England. IAHS Publication No. 171,
1987. p 1-7.

Descriptors: *Hydrology, *Research needs, Future planning, Hydrologic cycle, Water demand, Economic aspects, Land use, Developing countries.

Because of the limited volume and large fluctua-tions of fresh water resources of the globe, an understanding of the laws governing water distri-bution and its circulation in the hydrological cycle, i.e. the domain of interest of hydrological sciences, is now and increasingly in the future will be of paramount importance. Unavailability of water in sufficient quantity and quality has been and will continue to be an increasing constraint on econom-ic growth. An increase in water demand is certain, although there are large discrepancies in the assess-ment of how this may take place. Global water demand in the year 2000, evaluated by different scientists, ranges from 5000 to 20,000 km/yr. This is still well below the lower bound estimate of global supply (40,000 km/yr), but these figures is still well below the lower bound estimate of global supply (40,000 km/yr), but these figures pertain to the aggregated global scale and give no information about the severity of problems that may arise at a particular place and time. Large, and to a certain extent irreversible, anthropogenic changes can be identified and include such impacts a interregional water transfer, defrestation, ussamples can to untituted and include such impacts as interregional water transfer, deforestation, urbanization, pollution, acid rain, stratospheric ozone depletion and the 'greenhouse effect' caused by the build-up of CO2 and other gases in the atmosphere. Although efforts have been made to understand and to describe the problems of hydrology in developing countries, there still exist vital gaps in knowledge. Less effort is directed to basic research on physical, chemical and biological processes and to the implementation of the new techniques in operational practice. When trying to forecast the developments of hydrology as a scientific discipline, three aspects have to be considered: gaps in knowledge, extrapolation of existing trends, and anticipation of further inputs from outside hydrology. (See also W89-02717) (Lantz-PTT)

SURFACE WATER HYDROLOGY.

Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
For primary bibliographic entry see Field 2E.
W89-02719

HYDROLOGY VERSUS WATER RESOURCES MANAGEMENT, Slovenska Akademia Vied, Bratislava (Czechoslovakia). Ustav Hydrologie a Hydrauliky. J. Szolgay, and L. Gottschalk. IN: Hydrology 2000. International Association of Hydrological Sciences, Inst. of Hydrology, Wallingford, England. IAHS Publication No. 171, 1987. p 63-69.

Descriptors: *Research priorities, *Hydrology, *Water resources development, *Management planning, Forecasting, Stochastic hydrology, Model studies, Hydrologic models, Statistical studies, Meteorology.

Hydrologists have proposed useful techniques that may be applied in water resources management. Although these hydrological techniques have been substantially refined, they produce uncertainties that add to other uncertain aspects of water resources management, such as demand forecasting, system optimization goals and so on. By taking into account the apparent insufficiencies of existing methods and by extrapolating recent trends, it is likely that hydrologists will concentrate on topics such as: (1) stochastic streamflow generation for shorter time intervals such as pentades and days; (2) new multisite streamflow generation schemes; (3) modeling of time series of variables that have not been used intensively in the past, such as meteorological and chemical series; (4) joining stochastic modeling of different hydrological processes, such as input into deterministic models for the assessment of the impact of man's activities; (5) multisite flood frequency analysis; (6) semi-distributed and distributed rainfall-runoff models; and (7) statistical drought and low flow analysis. In order to ensure the credibility of the present methods and of those to be developed on the same basis in the future, a much deeper understanding of the mechanisms governing hydrological, climatic and meteorological processes is required. This in turn involves the need to initiate a broad interdisciplinary program of basic research, not only within the aforementioned sciences but in association with areas such as solar-planetary relations or various paleo-disciplines. (See also W89-02717) (Lantz-PTT)

MATHEMATICAL MODELLING,

Polish Academy of Sciences, Warsaw. Inst. of

Geophysics.
Z. W. Kundzewicz, A. Afouda, and J. Szolgay.
IN: Hydrology 2000. International Association of Hydrological Sciences, Inst. of Hydrology, Wal-lingford, England. IAHS Publication No. 171, lingford, En 1987. p 71-78.

Descriptors: *Mathematical models, *Model stud-ies, *Data interpretation, Hydrologic models, Forecasting, Data acquisition, Research priorities, Future planning, Simulation, Prediction.

The main aims for which a plethora of mathematical models of hydrological systems have been developed are an improved understanding of hydrological processes and operational benefits (simulation or forecast of performance of hydrological systems). The basic impediment to progress in mathematical modeling has been analyzed and it appears that the computational barrier is hardly relevant in hydrology. A barrier lies rather in the acquisition of data necessary for identification and verification of models. However, existing models may not fit well to the data available in some areas (e.g., remotely sensed representation of spatial may not it well to the data available it some areas (e.g., remotely sensed representation of spatial fields of hydrological variables). Although a rapid increase in complexity of mathematical models in the last decades has been observed, doubts concerning their usefulness have arisen. An increase of model complexity often accompanies develop-ments in computer technology rather than reflect-ing progress in understanding hydrological proc-

Group 2A-General

esses. The inflation of models and the scarcity of comparative analyses make it rather difficult to choose the proper model for a particular application. The future development of mathematical modeling is seen in the provision of solutions to scale problems through application of reductionism and the holistic approach. The other mechanism of likely progress is through the replacement of descriptive empirical rules by causal laws of hydrology. Mathematical modeling of hydrological processes is viewed as a strong growth area of hydrological and water resources research in the forthcoming decades. (See also W89-02717) (Lantz-PTT) W89-02725 esses. The inflation of models and the scarcity of

HYDROLOGY AND DATA ACQUISITION, Oslo Univ. (Norway). Inst. of Geophysics. L. Gottschalk, and A. Askew. IN: Hydrology 2000. International Association of Hydrological Sciences, Inst. of Hydrology, Wal-lingford, England. IAHS Publication No. 171, 1987. p 79-90, 2 tab.

Descriptors: *Hydrology, *Data acquisition, *Automation, Economic aspects, Temporal distribu-tion, Spatial distribution, Future planning, Comtion, Spatial distribution puters, Hydrologic data.

Data acquisition is a subject of importance in both applied and theoretical hydrology. Hydrological phenomena are considered to be continuous in space and time, but observations are often made as point values. There exists a significant difference between the current theoretical view of hydrologibetween the current theoretical view or hydrologi-cal mass flows and states and what can actually be observed directly or indirectly. Point observations are not as a rule 'points' in time or in space but represent some temporal interval or some spatial surface. This situation need not be a problem when studying individual hydrological variables, but may cause difficulties when, for instance, balances may cause difficulties when, for instance, balances involving several variables are being evaluated and it is necessary for the observations to represent the same interval in tiem and the same surface in space. A scenario for a drastic shift in technology for data acquisition would include a reduction in the number of ground-based observation stations, increases in accuracy of observations and in their time and space resolution, improvements in data processing, increased mapping, and integration of hydrologic data bases. It is logical to propose that the new methods should only be introduced when and where their advantages over current tech-niques can be clearly demonstrated on both techniniques can be clearly demonstrated on both techni-cal and economic grounds. A total commitment to automation and computer-based techniques could place future development well beyond the reach of many countries due to the related requirement for economic resources, technical facilities and trained personnel. (See W89-02717) (Lantz-PTT) W89-02726

HYDROLOGY AND HYDROLOGISTS. Manchester Univ. (England). Dept. of Geography. D. N. Collins.

IN: Hydrology 2000. International Association of Hydrological Sciences, Inst. of Hydrology, Wal-lingford, England. IAHS Publication No. 171, 1987. p 91-100.

Descriptors: *Hydrology, *Personnel, *Research priorities, Model studies, Future planning, Fore-casting, Training, Funding, Global environment, Environmental effects.

In order to avoid misconceptions and to allow hydrology to develop as a science, increasing de-lopment of conceptual and physically-based model-ing will be needed. Prediction will require an ing will be needed. Prediction will require an explanatory basis. Interdisciplinary research will be necessary in cooperative efforts to allow prediction and understanding in solving the interrelated great environmental problems of the future: climatic variation, global pollution and large scale vegetational change. With the increasingly parochial relevance criteria of national research funding bodies, care must be taken, through concerted international efforts, to ensure that questions of global importance are not neglected. Hydrologists can and should provide substantive inputs to re-

search needs for predicting and understanding future global environmental scenarios, since at the same time the scientific basis of hydrology itself is strengthened. (See also W89-02717) (Lantz-PTT) W89-02727

STABLE ISOTOPES: AN INVESTIGATION INTO THEIR APPLICATION IN KARST HYDROLOGY IN THE U.K., WITH SPECIAL REFERENCE TO THE MALHAM AREA, NORTH

VORKSHIRE, Oxford Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2F. W89-02734

STORMFLOW CHARACTERISTICS OF THREE SMALL LIMESTONE DRAINAGE BASINS IN NORTH ISLAND, NEW ZEALAND, BASINS IN NORTH ISLAND, NEW ZEALAND, Manchester Polytechnic (England). Dept. of Environmental and Geographical Studies. J. Gunn, and B. Turnpenny. IN: New Directions in Karst. Geo Books, Norwich, England. 1986. p 233-258, 9 fig, 7 tab, 56 ref.

Descriptors: *Limestone, *Surface-groundwater relations, *Drainage area, *Karst hydrology, *Storm runoff, Caves, Karst, Catchment areas, New Zealand, Discharge hydrographs, Stream-

The small experimental basin approach, rarely used in karst areas, formed the basis for an examination of subterranean streamflow characteristics in three New Zealand catchments. Two of the basins lie to the west of Waitomo Caves and the third is south of Port Waitato. In the Waitomo basins, which are entirely autogenic with no surface drainage, the of Port Waikato. In the Waitomo basins, which are entirely autogenic with no surface drainage, the subterranean streams receive both diffuse percolation recharge and concentrated recharge from closed depressions. By way of contrast the Port Waikato basin has mixed lithologies and the subterranean stream is recharged mainly by allogenic and autogenic percolation. The Waitomo basins were instrumented for 14 months and the Port Waikato basin for 8 months. Storm hydrographs from each basin were analyzed using time-based separation techniques, and stormflow parameters were evaluated in accordance with the methods of surface water hydrologists. Stormflow duration and time to peak are similar in all three basins, but the Port Waikato stream has a higher stormflow yield and peakflow magnitude and a lower antecedent baseflow than the two Waitomo streams. These differences may be accounted for by the allogenic rehow than the two Waitomo streams. These differences may be accounted for by the allogenic recharge and by the low storativity of both the Port Waikato limestones and the overlying soils. There are also differences between the stormflow yields, peakflow magnitudes and antecedent baseflows in the two Waitomo basins and these are ascribed to human modifications (mainly forest clearance) which have increased the storage capacity of one basin. A more general comparison of the stormflow parameters with published figures from surface drainage basins indicates that the three limestone basins are not anomalous but form part of a continuum of natural hydrological systems. Hence continuum of natural hydrological systems. Hence continuum of natural hydrological systems. Hence it is suggested that karst hydrologists should pay greater attention to the concepts and methodology of surface water hydrology. (See also W89-02728) (Author's abstract) W89-02735

PEAK/RISK/CULVERT: A PROGRAM TO COMPUTE PEAK FLOWS, HYDROLOGIC RISK, AND CIRCULAR CULVERT SIZES AT FOREST ROAD CROSSINGS,

Bureau of Land Management, Roseburg, OR. For primary bibliographic entry see Field 2E. W89-02831

EXPERIMENTAL GEOMORPHOLOGY (DRAINAGE NETWORK, PIEDMONT AND CHANNEL MORPHOLOGY), Colorado State Univ., Fort Collins. For primary bibliographic entry see Field 2J. W89-02847

FLOODPLAIN RESPONSE OF A SMALL TROPICAL STREAM.

Reading Univ. (England). Dept. of Soil Science. For primary bibliographic entry see Field 2E. W89-02885

RIVER RESPONSE TO CATCHMENT CONDI-TIONS, Jonkershoek Forest Research Station, Stellenbosch

(South Africa).
For primary bibliographic entry see Field 2H.
W89-02990

POTENTIAL IMPACTS OF A SCENARIO OF CO2-INDUCED CLIMATIC CHANGE ON ONTARIO, CANADA,
Canadian Climate Centre, Downsview (Ontario).
S. J. Cohen, and T. R. Allsopp.
Journal of Climate, Vol. 1, No. 7, p 669-681, July 1988. 2 fig, 6 tab. 28 ref.

Descriptors: *Canada, *Greenhouse effect, *Air pollution effects, *Climatology, *Atmosphere, *Carbon dioxide, *Great Lakes, *Precipitation, Snow, Temperature, Model studies, Navigation, Hydroelectric power, Municipal water, Tourism, Recreation, Ontario.

In 1984, Environment Canada, Ontario Region ini-tiated an interdisciplinary pilot study to investigate the potential impact of a climate scenario which might be anticipated under doubling of atmospher-ic CO2 conditions. There were many uncertainties in the climate scenario development and the imin the climate scenario development and the impacts modeling. Time and resource constraints restricted this study to one climate scenario and to the selection of several available models that could be adapted to these impact studies. The study emphasized the approach and process required to investigate potential regional impacts in an interdisciplinary manner, rather than to produce a forecast of the future. The tensario charge were a foreuscipinary mainter, rather than to produce a fore-cast of the future. The scenario chosen was adapt-ed from experimental model results produced by the Goddard Institute for Space Studies, coupled with current climate normals. Gridded monthly with current climate normals. Gridded monthly mean temperatures and precipitation were used to develop projected biophysical effects. The second phase addressed the impacts of the climate system scenario on natural resources and resource dependent activities, e.g. the impacts of projected decreased lake levels and outflows on commercial navigation and hydroelectric generation. The impacts of the climate scenario on municipal water use, residential heating and cooling energy requirements, opportunities and constraints for food production and tourism and recreation were determined quantitatively where models and methodologies were available, otherwise, qualitatively. First order interdependencies of the biophysical effects of the FiBclimate scenario and resource dependent activities were evaluated qualitatively in a workshop format culminating in a series of stateworkshop format culminating in a series of state-ments on (i) possible preventive, compensatory and substitution strategies, and (ii) an assessment of current knowledge gaps and deficiencies, with rec-ommendations for future areas of research. (Author's abstract) W89-03063

PHYSICAL ENERGY INPUTS AND THE COM-PARATIVE ECOLOGY OF LAKE AND MARINE ECOSYSTEMS, Rhode Island Univ., Narragansett. Graduate School of Oceanography.

S. W. Nixon.

Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 1005-1025, July 1988. 6 fig, 6 tab, 158 ref.

Descriptors: *Ecology, *Lakes, *Energy sources, *Limnology, *Reviews, *Tidal energy, *Coastal waters, Comparison studies, Cycling nutrients.

Although freshwater and marine systems both re-ceive light and heat energy from the sun and are mixed by the wind, only marine systems receive additional mechanical energy from the tide. This input is very small relative to the flux of solar energy but may exceed that from wind. Some obvious physical consequences of this additional energy input include the development of intertidal

Precipitation—Group 28

habitats, the presence of stronger currents, and more vigorous vertical mixing. It is argued that these consequences lead to coastal marine ecosystems which differ in a number of important ways from temperate lakes. There is some evidence that coastal marine ecosystems generally maintain a larger standing crop of benthic animals and that these fauna are more effective in mixing the bottom sediments. As a result of better sediment mixing creating matter denoising on the bottom of these fauna are more effective in mixing the bottom sediments. As a result of better sediment mixing, organic matter deposited on the bottom of coastal marine areas may be more completely metabolized and less carbon, nitrogen and phosphorus retained than in lake sediments. Materials that are more tightly bound to particles, like many metals, may behave similarly in lake and marine sediments. Although many lakes are strong sinks for nutrients and metals, marine bays and estuaries may be much less effective in retaining nutrients. A major consequence of the input of tidal energy appears to be more intensive fish yield from marine systems compared with temperate lakes. The data suggest that this more intense yield is not due to the size or interconnection of marine areas or to higher primary production. Rather, the efficiency of transfer of primary production of fish appears to be greater. Tropical lakes appear more like marine systems in his regard, and this may be related to lower thermal stability and more efficient wind energy transfer because of small Coriolis effect at low latitudes. (Author's abstract)

2B. Precipitation

EFFECTS OF ATMOSPHERIC POLLUTANTS ON FORESTS, WETLANDS AND AGRICUL-TURAL ECOSYSTEMS.

For primary bibliographic entry see Field 5B. W89-02304

CONSEQUENCES OF CLOUD WATER DEPO-SITION ON VEGETATION AT HIGH ELEVA-

Institute of Terrestrial Ecology, Edinburgh (Scot-

For primary bibliographic entry see Field 5B. W89-02305

RESULTS OF INTERCOMPARISON STUDIES FOR THE MEASUREMENTS OF PH AND SPE-CIFIC CONDUCTANCE AT NATIONAL AT-MOSPHERIC DEPOSITION PROGRAM/NA-TIONAL TRENDS NETWORK MONITORING SITES, OCTOBER 1981-OCTOBER 1985, Geological Survey, Lakewood, CO. Water Re-

sources Div. For primary bibliographic entry see Field 5A. W89-02485

EFFECTS OF SNOW COVER AND TROPICAL FORCING ON MID-LATITUDE MONTHLY MEAN CIRCULATION,

Maryland Univ., College Park. Dept. of Meteorol-

For primary bibliographic entry see Field 2C. W89-02625

REVIEW OF 183 GHZ MOISTURE PROFILE RETRIEVAL STUDIES,

Atmospheric and Environmental Research, Inc., Cambridge, MA. For primary bibliographic entry see Field 7C. W89-02705

ACID PRECIPITATION. CITATIONS FROM THE COMPENDEX ENGINEERING INFOR-MATION INC. DATABASE (SEPT 84 - AUG 86).

National Technical Information Service, Spring-

For primary bibliographic entry see Field 5B. W89-02784

ACID PRECIPITATION, CITATIONS FROM THE COMPENDEX ENGINEERING INFOR-MATION INC. DATABASE (SEPT 86 - AUG 87),

National Technical Information Service, Spring-field, VA.

For primary bibliographic entry see Field 5B. W89-02785

CUMULUS AND THUNDERSTORM INITI-ATION BY MOUNTAINS, Air Force Geophysics Lab., Hanscom AFB, MA. R. Banta.

R. Banta. Available from the National Technical Information Service, Springfield, VA. 22161, as AD-A182 863. Price codes: A12 in paper copy, A01 in microfiche. Report No. AFGL-TR-87-0227, July 21, 1987. 6p.

Descriptors: *Weather patterns, *Orographic precipitation, *Clouds, *Thunderstorms, *Mountains, Convection, Satellite technology, Data interpretation, Mathematical models, Wind, Model studies.

Mountains are strong organizers of cumulus convection, especially during late-morning hours in summer. Factors affecting mountain thunderstorm initiation were investigated using two approaches: analysis of GOES satellite data and dynamic numerical cloud modeling. Using three summers of GOES data, over 600 thunderstorms were traced back to their initiation points in the Colorado pountains to determine areas of received thunders. next to their mitiation points in the Colorado mountains, to determine areas of repeated thunder-storm genesis. Genesis zone activity depended on the direction of the winds above the ridgetops, indicating upper-level wind direction to be a likely predictor of the location of mountain thunderstorm mitiations. Other feature affection and with the coloradors. predictor of the location of mountain thunderstorm initiations. Other factors affecting cloud initiation were investigated using a 2-D mesoscale numerical model, including strength of ridgetop-level winds, magnitude of surface heat flux, and soil moisture content. Stronger winds aloft, lower surface heat flux, and higher soil moisture all inhibited mountain cloud-producing mechanisms. (Author's abstract) stract) W89-02787

OBSERVATION OF STRATIFORM RAIN WITH 94 GHZ AND S-BAND DOPPLER RADAR,

Rosenstiel School of Marine and Atmospheric Sci-R M Lhermitte

R. M. Lhermitte.
Available from the National Technical Information
Service, Springfield, VA 22161, as AD-A192 013.
Price codes: A03 in paper copy, A01 in microfiche.
Report No. AFGL-TR-87-0268, September 30, 1987. Scientific Report No. 1. 18p, 10 fig, 1 tab, 2

Descriptors: *Meteorological data collections, *Data acquisition, *Radar, *Rain, *Remote sensing, Weather, Doppler radar, Precipitation.

The physics and dynamics of stratiform rain were studied by observing the vertical profiles of Dopp-ler velocities and radar reflectivity using radars in studied by observing the vertical profiles of Doppler velocities and radar reflectivity using radars in a vertically pointing mode. Data were collected with a 94 GHz (3-mm wavelength) Doppler radar, with these observations done jointly with a K subz-band (35 GHz) and an S-band (3 GHz) radar operated by AFGL. The research effort is divided into two phases: (a) A pilot experiment primarily concerned with a test of the installation of the 94 GHz Doppler radar at the AFGL site and its operation in all weather conditions; (b) A field experiment in the fall of 1987 with the 94 GHz radar observing stratiform rain in a vertically pointing mode in conjunction with K subz-band and S-band radar observations. The primary objectives are to observe (i) vertical profiles of radar reflectivity at the three wavelengths; (ii) vertical profiles of mean Doppler (pulse pair processor) at 94 GHz and 3 GHz; (iii) sampling of the full Doppler spectra at critical or sensitive altitude levels in the cloud at 94 GHz and possibly at 3 GHz. The progress report includes an account of the pilot experiment which took place during May 1986 at the AFGL site in Sudbury, MA, followed by formulation of the plans concerning contributions to the experiment scheduled to take place at the same site in October-November, 1987. (Lantz-PTT) W89-02830

SATELLITE RAINFALL RETRIEVAL BY LO-GISTIC REGRESSION, Applied Research Corp., Landover, MD. For primary bibliographic entry see Field 7C. W89-02854

FISCAL YEAR 1985 SUMMARY REPORT OF NOAA METEOROLOGY DIVISION SUPPORT TO THE ENVIRONMENTAL PROTECTION AGENCY.

AGENCY. National Oceanic and Atmospheric Administra-tion, Rockville, MD. Air Resources Labs. For primary bibliographic entry see Field 5B. W89-02857

STUDIES OF THE MECHANISMS AND RATES WITH WHICH NITROGEN SPECIES ARE INCORPORATED INTO CLOUD WATER AND PRECIPITATION,

Washington Univ., Seattle. Dept. of Atmospheric Sciences.

For primary bibliographic entry see Field 5B. W89-02862

NATIONAL ACID PRECIPITATION ASSESS-MENT PROGRAM: ANNUAL REPORT, 1986. National Acid Precipitation Assessment Program, Washington, DC. Office of the Director of Research. For primary bibliographic entry see Field 5B. W89-02873

NAPAP OPERATING RESEARCH PLAN: 1986-1988.

Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab. For primary bibliographic entry see Field 5B. W89-02876

DEVELOPMENT AND FIELD USE OF A SNOW COLLECTOR FOR ACID PRECIPITA-

TION STUDIES,
Warren Spring Lab., Stevenage (England).
For primary bibliographic entry see Field 5B.
W89-02945

TROPICAL AND MONSOONAL STUDIES,

TROPICAL AND MONSOONAL STUDIES, Naval Postgraduate School, Monterey, CA. C. P. Chang, and R. T. Williams. Available from the National Technical Information Service, Springfield, VA 22161, as AD-A188 287. Price codes: A06 in paper copy, A01 in microfiche. Final Technical Report for period June 1984-No-vember 1987, January 1988. 169p. NSF Grant ATM-83-15175.

Descriptors: *Climatology, *Meteorology, *Tropical regions, *Monsoons, Tropical cyclones, Precipitation, Wind, Shear, Convection, Storms.

Large-scale motions in the tropics and subtropics particularly those associated with the Asian monsoon circulations were studied. Four areas were investigated: (1) Theoretical studies of planetary scale motion forced by tropical heating - the effects of vertical shear, vertical differential damping and planetary boundary layer were found to influence the forcing of midlatitude motions by tropical best sources. In edition, the vertical interestion of heat sources. In addition, the vertical interaction of simple modes may be responsible for the maintesimple modes may be responsible for the mainte-nance of the eastward propagating 30-50 day oscil-lations; (2) Observational studies of planetary scale motions - The day to day variation of the East Asian Jet was found to correlate positively with that of the tropical divergent flow south of it, suggesting the importance of tropical forcing through the local Haddley cell. The transient forc-ing of time-mean planetary scale circulation was also studied using a nine-year data set; (3) Theoret-ical studies of zonal asymmetry - several differ-ences between parallel flow and non-parallel flow instabilities in terms of spatial and time growth rates were found using the two-scale technique; and (4) Studies of the Mei-Yu system of the East Asian summer monsoon - A numerical experiment Asian summer monsoon - A numerical experiment suggested that the Low-Level Jet associated with

Group 2B—Precipitation

intense Mei-Yu front receives energy through an equatorward, convection-driven secondary circulation which is quite different from the cross-frontal circulation associated with dry fronts. (Author's abstract)

DESIGN OF THE PRIMARY PRE-TRMM AND TRMM GROUND TRUTH SITE, Virginia Univ., Charlottesville. Dept. of Environ-

mental Sciences.
For primary bibliographic entry see Field 7A.
W89-02971

ESTIMATING MAGNITUDE AND FREQUEN-CY OF FLOODS FOR WISCONSIN URBAN STREAMS,

Geological Survey, Madison, WI. Water Resources Div. For primary bibliographic entry see Field 2E. W89-03003

VEGETATION AND CLIMATES OF THE LAST 45,000 YEARS IN THE VICINITY OF THE NEVADA TEST SITE, SOUTH-CENTRAL NEVADA, For primary bibliographic entry see Field 7C. W89-03024

STOCHASTIC MODELLING OF RAINFALL OCCURRENCES IN CONTINUOUS TIME, National Technical Univ., Athens (Greece). Dept. of Civil Engineering.

G. Tsakiris. Hydrological Sciences Journal HSJODN, Vol. 33, No. 5, p 437-447, October 1988. 7 fig. 25 ref.

Descriptors: *Rainfall, *Model studies, *Rainfall distribution, *Stochastic models, Temporal distribution, Mathematical models, Hydrologic models, Alternating renewal process, Probability distribution, Greece, Irrigation requirements, Meteorologi-

There is no unified mathematical model incorporating the modeling of both frequency and amount of rainfall with a universal acceptability. The use of the Alternating Renewal Process is proposed for the evaluation of probability-distribution functions for total wet and dry periods over a homogeneous time interval. The derived general solution is simplified by assuming that the individual wet and dry intervals are random variables following an Erlang distribution, in particular, an exponential distribution. Data on a continuous time scale from the tion. Data on a continuous time scale from the Mikra Station in Greece are used to illustrate the methodology. Using the model, important information are also as a second of the second tion regarding expected irrigation-water require-ments may be derived. Also due to the detailed nuorinauon obtained, the model can be used in a variety of hydrological problems, dependent on the duration of the rainy period. A serious draw-back of the model is that it uses continuous autographic-recorder rainfall data which are not always available. (Shidler-PTT)
W89-03049 information obtained, the model can be used in a

EURASIAN SNOW COVER AND SEASONAL FORECAST OF INDIAN SUMMER MONSOON

RAINFALL, Nairobi Univ. (Kenya). Dept. of Meteorology. O. S. R. U. Bhanu Kumar. Hydrological Sciences Journal HSJODN, Vol. 33, No. 5, p 515-525, October 1988. 5 fig, 1 tab, 23 ref.

Descriptors: *Monsoons, *Rainfall, *Snow cover, *Weather patterns, *Climatology, *Weather fore-casting, *India, *Eurasia, Snowmelt, Satellite tech-nology, Seasonal variation, Mathematical studies, Correlation analysis, Regression analysis.

The relationship between Indian summer-monsoon The relationship between Indian summer-monsoon total rainfall and two parameters from Eurasian snow cover—the winter snow-cover extent and the area of spring snowmell. Satellite-derived Eurasian snow-cover extent and Indian monsoon rainfall data for the period 1966-1985 were used. Seasonal cyclic variations of group cover showed whicher cyclic variations of snow cover showed a higher

swing in both the winter and the spring seasons of the cycle as compared with the remaining seasons of the year in the lower region of the cycle. The established inverse relation between winter snow cover and monsoon rainfall during June to Septem-ber was further extended. Winter snow cover is very strongly correlated with spring snowmelt over Eurasia. Spring snowmelt area is obtained by over Eurasia. Spring snowmelt area is obtained by subtracting the May snow-cover extent from that of the previous February. The variations of spring snowmelt were also compared with Indian total monsoon rainfall. The detected correlation is stronger between snowmelt and monsoon rainfall than between the winter snow cover and the monsoon rainfall. There is also a significant multiple correlation among winter snow cover, spring snowmelt, and monsoon rainfall. Lastly, a significant multiple correlation suggested a multiple-regression equation which might improve the climatic prediction of monsoon rainfall over India. (Author's abstract) thor's abstract) W89-03054

POTENTIAL IMPACTS OF A SCENARIO OF CO2-INDUCED CLIMATIC CHANGE ON ON-

CONTRIDCED CLIMATIC CHARGE ON ON-TARIO, CANADA, Canadian Climate Centre, Downsview (Ontario). For primary bibliographic entry see Field 2A. W89-03063

REVERSIBILITY OF ACIDIFICATION SHOWN BY WHOLE-CATCHMENT EXPERI-

Norsk Inst. for Vannforskning, Oslo. For primary bibliographic entry see Field 5B. W89-03120

OKLAHOMA-KANSAS MESOSCALE CONVECTIVE SYSTEM OF 10-11 JUNE 1985: PRECIPITATION STRUCTURE AND SINGLE-DOPPLER RADA ANALYSIS,
Oregon State Univ., Corvallis. Dept. of Atmosphesis Spirits.

Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences. S. A. Rutledge, R. A. Houze, M. I. Biggerstaff, and T. Matejka. Monthly Weather Review MRWEAB, Vol. 116, No. 7, p 1409-1430, July 1988. 15 fig. 1 tab, 34 ref. NSF Grants ATM-841546, ATM-8419543, ATM-8521403, ATM-8602411 and ATM-8608467.

Descriptors: *Weather satellites, *Radar, *Storms, *Weather, *Precipitation, *Convective precipitation, Oklahoma, Kansas, Doppler radar analysis.

The 10-11 June mesoscale convective system ob served in Kansas during pre-storm was studied using a variety of observations including conventional radar, satellite, and single-Doppler radar. This storm, at maturity, consisted of a strong line of convection trailed by a broad region of stratiform rain. The pre-storm Doppler radar observations showed that the general airflow pattern is tions showed that the general airflow pattern is similar to that seen in previously analyzed cases; however, since the Doppler observations were quite extensive in time and space, they permit several details of the airflow to be revealed for the first time. A rear inflow jet, front-to-rear flow aloft, and a mesoscale updraft and downdraft were all present. The mesoscale downdraft commenced at the top of the slanted rear inflow jet. Sublimation and evaporation of hydrometers in this flow apparently generated the necessary cooling to drive the mesoscale downdraft circulation. The intensity and slope of the rear inflow jet varied with location in the storm, which apparently led to differences in both intensity and depth of the mesoscale downdraft. The intrusion of this inflow jet into the rear of storm occurred at quite high levels soscale downarat. The intrusion of this inflow jet into the rear of storm occurred at quite high levels and was probably responsible for disruption of the continuous oval cloud shield as viewed by satellite. The front-to rear flow situated above the rear inflow jet contained mesoscale upward motion. Vertical velocities obtained by the Extended Velocity-Azimuth Display method revealed a strong mesoscale updraft, with speeds approaching 50 cm per s. Vertically pointing observations indicated that convective-scale updrafts and downdrafts were present within 20 km of the convective line. Convective-scale features were not observed in the remaining portion of the trailing stratiform region. (Author's abstract)

W89-03273

RELATIONSHIP OF SURFACE PRESSURE FEATURES TO THE PRECIPITATION AND AIRFLOW STRUCTURE OF AN INTENSE MIDLATITUDE SQUALL LINE, Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

Monthly Weather Review MRWEAB, Vol. 116, No. 7, p 1444-1472, July 1988. 25 fig, 1 tab, 60 ref,

Descriptors: *Surface pressure, *Precipitation, *Squalls, *Storms, *Air circulation, *Meteorology, *Weather, Oklahoma, Kansas, Temperature.

Observations from the Oklahoma-Kansas Preliminary Regional Experiment for storm-Central have been used to document the surface pressure features accompanying an intense midlatitude squall line with trailing stratiform precipitation. Three well-known features were observed: (1) a presquall mesolow, (2) a squall mesohigh, and (3) a wake low. Particular attention was given to the wake low, its life cycle and association with the trailing stratiform portion of the squall line. During the formative stage, the pressure field to the rear of the squall intense that the squall line enters the developing-to-mature stages, a pronounced wake low appears at the back edge of the surface stratiform precipitation area. The squall line at this time is characterized by a strong rear-inflow jet, descending from the upper troposphere Observations from the Oklahoma-Kansas Prelimiline at this time is characterized by a strong rear-inflow jet, descending from the upper troposphere just behind the line. The trailing stratiform cloud constitutes a significant part of the squall-line water budget, contributing 29% of the total squall line precipitation over a 400 km by 500 km meson-etwork area experiencing its passage. During the mature-to-dissipating stages, the trailing stratiform region splits into two segments. A composite anal-ysis of rawinsonde data at this time showed strong warming and draving in the lower traposchare. ysis of rawinsonde data at this time showed strong warming and drying in the lower troposphere at the back edge of the stratiform regions. Based on results of this study, it is proposed that the wake low, which can be attributed to subsidence warming, is a surface manifestation of the descending rear-inflow jet and that the warming is maximized at the back edge of the trailing stratiform precipitation area where there is insufficient sublimation and evaporative cooling to offset adiabatic warming. (Author's abstract) W89-03274

EFFECTS OF SIMULATED ACID RAIN ON SUGAR MAPLE SEEDLING ROOT GROWTH, State Univ. of New York, Syracuse. Coll. of Envi-For primary bibliographic entry see Field 5C. W89-03300

DIAGNOSTIC TECHNIQUE FOR TARGETING

DIAGNOSTIC TECHNIQUE FOR TARGETING OURING AIRBORNE SEEDING EXPERIMENTS IN WINTERTIME STORMS OVER THE SIERRA NEVADA, Electronic Techniques, Inc., Fort Collins, CO. R. M. Rauber, R. D. Elliott, J. O. Rhea, A. W. Huggins, and D. W. Reynolds.

Journal of Applied Meteorology JAMOAX. Vol. Huggins, and D. W. Reynolds. Journal of Applied Meteorology JAMOAX, Vol. 27, No. 7, p. 811-828, July 1988. 11 fig. 3 tab, 50 ref. Department of Interior contracts 9-07-85-V0021, 4-CR-81-03860, and 7-07-83-V0008.

Descriptors: *Storms, *Sierra Nevada, Cloud seeding, *Aircraft, *Weather modification, *Wind, *Ice, *Radar, Targeting, Wind fields, Cloud, Particulate matter, Radar echo evolution.

A diagnostic technique for targeting during air-borne seeding experiments has been developed for the Sierra Cooperative Pilot Project. This tech-nique was used operationally during Sierra Coop-erative Pilot Project for real-time guidance to air-craft, providing: (1) the location and orientation of the seeding line required to target ice particles created by seeding to a specified ground location, and (2) an estimate of the areal coverage of the seeding effect on the ground. Use of this technique

Snow, Ice, and Frost—Group 2C

as a real-time guidance tool during seeding oper-ations in Sierra wintertime storms is discussed. Three evaluation studies of the targeting method are presented: (1) comparisons of diagnosed wind fields with those measured by aircraft, (2) comparisons of ice particle growth rates and habits within seeded cloud regions with those used in the target-ing computations, and (3) comparison of radar echo evolution within seeded cloud regions with calculated particle trajectories. The diagnosed wind fields over Sierra Nevada were found to wind fields over Sierra Nevada were found to generally correspond to aircraft measurements of wind speed and direction within the lower atmosphere (<5000 m) upwind of the crestline. Errors in the u- and v-components of the wind were generally <4 m per s over the 100 km domain upwind of the crest. Comparison of predicted ice particle habits and growth rates with those measured within seeded regions of storms were made during 11 storm systems. Ice particles were sampled by aircraft 4-81 min after seeding. Particle habits and growth rates used in the targeting parametrization generally agreed with measurements taken in the temperature range -8 to 13 C. At warmer temperatures, particle growth rates were generally overestimated. A case study comparing radar echo evolution in seeded cloud regions with predicted particle trajectories was presented. In general good tion in second regions with predicted parti-cle trajectories was presented. In general good agreement between radar echo evolution and pre-dicted particle trajectories was obtained. The pre-dicted falltime was nearly identical to the radar results, but the predicted fallout location differed by 5 km. (Miller-PTT) W89-03305

ESTIMATE OF PRECIPITATION ENHANCE-MENT POTENTIAL FOR THE DUERO BASIN

Wyoming Univ., Laramie. Dept. of Atmospheric Science. For primary bibliographic entry see Field 3B. W89-03306

NIMBUS-7 GLOBAL CLOUD CLIMATOLOGY: PART I. ALGORITHMS AND VALIDATION, National Environmental Satellite, Data, and Infor-mation Service, Washington, DC. L. L. Stowe, C. G. Wellemeyer, T. F. Eck, and H. Y. M. Yeh.

Journal of Climate, Vol. 1, No. 5, p 445-470, May 1988. 16 fig. 5 tab, 42 ref.

Descriptors: *Clouds cover, *Climatology, *Infrared radiation, *Meteorological data collection, *Meteorology, *Radiometry, Satellite technology, Remote sensing, Algorithms, Performance evalua-

Data from the Temperature Humidity Infrared Radiometer and the Total Ozone Mapping Spectrometer, both aboard the Nimbus-7 satellite, are used
to determine cloudiness parameters for the globe.
The 11.5 micron Temperature Humidity Infrared
Radiometer radiances and the 0.36 micron and 0.38
micron Total Ozone Mapping Spectrometer reflectivities, along with concurrent surface temperature
data from the Air Force 3-D nephanalysis, are the
primary data sources. They are processed by an
algorithm that determines total cloud amount,
cloud amount in three altitude categories, cirrus
cloud, deep convective cloud, warm cloud, and the
radiance of radiation emitted by the clouds and the
underlying surface. The algorithm is of the bispectral threshold type, which yields two independent
estimates of total cloud, one from the infrared
algorithm and one from the ultraviolet reflectivity
algorithm. For the daytime observations, these two
independent estimates are combined to determine a algorithm. For the daytime observations, these two independent estimates are combined to determine a composite estimate. Quantitative validation of total cloud amount was performed by comparing the algorithm results with estimates derived by an analyst interpreting geosynchronous satellite images, along with auxiliary meterological data. It has been concluded that the systematic errors of the Nimbus-7 total cloud amount algorithm relative to the analyst are less than 10% and that the random errors of daily estimates range between 7% and 16%, day or night. Qualitative validation has also been performed by making comparisons with the geosynchronous satellite visible and infrared images for specific days. Results indicate that

the Temperature Humidity Infrared Radiometer cloud estimates improve the infrared algorithm estimates of low cloud amount and provide for the identification of cirrus and deep convective cloud, but cloud amounts over humid tropical regions tend to be overestimated even with the use of Temperature Humidity Infrared Radiometer. These results suggest that the spatial and temporal characteristics of daily and monthly averaged globe cloud cover, including cirrus and deep convective cloud types are generally well represented by the Nimbus-7 dataset, which covers a six-year period from April 1979 to March 1985. (Author's abstract)

2C. Snow, Ice, and Frost

SNOW WATCH '85. Lamont-Doherty Geological Observatory, Pali-

sades, NY.

Available from the National Technical Information
Service, Springfield, VA 22161, as DE86-011983.

Price codes: AlOi paper copy, AOI in microfiche.
Glaciological Data Report GD-18. March 1986.

Published by World Data Center for Glaciology,
Boulder, CO. 276p. Edited by G. Kukla, R.G.

Barry, A. Hecht and D. Wiesnet.

Descriptors: *Snow cover, *Meteorological data collection, *Climatology, Model studies, Simulation, Carbon dioxide.

A workshop was held in October 1985 at the University of Maryland on the topic of snow cover and its role in the climate system, specifically as it may relate to potential carbon dioxide-induced climatic changes. The workshop was a follow-up to an earlier SNOW WATCH conference held in Washington, D.C. in 1980. The 40 participants from four countries, divided into three working groups, discussed questions of data bases, the role of snow cover in the climate system, and the modeling and simulation of snow cover processes. (See W89-02607 thru W89-02629) (Sand-PTT) W89-02606

SNOW COVER, CYCLOGENESIS AND CY-CLONE TRAJECTORIES, Illinois Univ. at Urbana-Champaign. Dept. of At-

J. E. Walsh, and B. Ross.

J. E. Walsh, and B. Ross. Available the from National Technical Information Service, Springfield, VA 22161, as DE86-011983. Price codes: A12 in paper copy; A01 in microfiche. IN: Snow Watch '85. Glaciological Data Report GD-18. March 1986. p 23-36, 6 fig, 11 ref.

Descriptors: *Snow cover, *Meteorological data collection, *Sea ice, *Ice cover, *Cyclones, *Model studies, *Weather forecasting, Weather patterns, Climatology, Atmospheric pressure, Maps, Charts, North America, North Atlantic, North Pacific, Storms.

Samples of 75-150 cyclogenetic events in eastern North America, the North Atlantic and the North Pacific were obtained from daily data for 30 winters (1951-1980). The large-scale distribution of racitic were obtained from daily data for 30 winters (1951-1980). The large-scale distribution of
snow or sea ice cover was used to composite the
errors of forecasts derived from persistence, from a
barotropic model, and from an analog system. The
results are consistent with the notion that extensive
snow/ice cover contributes to stronger cyclogenesis and to southward displacements of storm tracks
along the East Coast of North America and in the
marginal ice zone of the North Atlantic. The apparent signal is statistically significant in these two
regions, although the significance is greater in the
sea level pressure data than in 550 mb data. No
corresponding signal was found in the North Pacific. Controlled experiments with the NoAR Community Forecast Model were performed to determine the response of a more sophisticated model to
extremes of snow and ice in eastern North America and the North Atlantic. While patterns similar
to the data-based results are found, the response in
the model pressure fields is weaker and farther
north of the snow/ice edge than in the corresponding results from the barotropic model and persist-

ence forecasts. (See also W89-02606) (Author's abstract) W89-02607

RELATIONSHIP BETWEEN SNOW COVER AND ATMOSPHERIC THERMAL AND CIRCU-AND ANOMALIES,
Nebraska Univ., Lincoln. Dept. of Geography.
K. F. Dewey, and R. Heim.

N. F. Dewey, and K. Heim.
Available from the National Technical Information Service, Springfield, VA 22161, as DE86-011983.
Price codes: A12 in paper copy; A01 in microfiche.
IN: Snow Watch '85. Glaciological Report GD-18.
March 1986. p 37-53. 6 fig, 9 tab, 21 ref.

Descriptors: Snow cover, *Meteorological data collection, *Cyclones, *Climatology, Maps, Charts, North America, Atmospheric pressure, Air temperature, Air circulation, Stori

Weekly snow cover areas, derived from the NOAA (National Oceanic and Atmospheric Ad-ministration)/NESS Northern Hemisphere Digi-tized Snow and Ice Cover Data Base, were correitzed Snow and Ice Cover Data Base, were correlated with weekly temperature anomalies across the United States as well as 500-mb geopotential heights, 700-mb geopotential heights, 700-mb geopotential heights, 700-mb geopotential heights, and sea level pressure across North America. The correlations were computed for snow cover across the entire North American continent as well as the western and eastern United States for the winters 1966-67 through 1982-83. This geographic partitioning allowed for an evaluation of what influence regional snow cover might have on the larger scale circulation. Negative and positive lag correlations were also computed to determine the magnitude and direction of influence (snow cover to atmosphere or the reverse). The winter seasons were divided into two groups (8 years each) based upon the average amount of snow cover for each winter season. The cyclonic storm tracks for the winters season. The cyclonic storm tracks for the winters with extensive snow cover were then compared to with extensive snow cover were then compared to the winters with least snow cover. In winters with extensive snow cover, the cyclonic storm track was displaced south and eastward resulting in increased cyclolonic activity across the southeastern and eastern coast regions of the U.S. It could not be determined whether extensive snow cover caused the shift in the cyclonic paths or the shift in the cyclonic paths or the shift in the cyclonic activity caused the extensive snow cover. (See also W89-02606) (Sand-PTT)

RELATIONSHIPS BETWEEN SNOW COVER AND TEMPERATURE IN THE LOWER TRO-POSPHERE, GENERAL CIRCULATION IN EAST ASIA AND PRECIPITATION IN CHINA, Beijing Univ. (China). Dept. of Geophysics.

Beijing Univ. (Cima). Dept. of Geophysics.

Z. Zhao, and S. Wang.

Available from the National Technical Information

Service, Springfield, VA 22161, as DE36-011983.

Price codes: A12 in paper copy; A01 in microfiche.

IN: Snow Watch '85. Glaciological Data Report

GD-18. March 1986, p 55-61. 5 fig, 8 ref.

Descriptors: "Weather patterns, "Snow cover, "Precipitation, "Meteorological data collection, "Asia, "China, Climatology, Air temperature, Air

Relationships between snow cover and temperature in the lower troposphere, general circulation at 500 mb in East Asia and precipitation in China were analyzed. There are obvious negative correlations between snow cover in the Northern Hemisphere in winter and temperature in the following summer. Significant negative correlations between sea ice in summer and temperature in the higher latitudes were noticed. Snow cover in Eurasia in winter influences the general circulation in East Asia and rainfall in China in the following spring and summer. When there is more snow cover in Asia and rainfair in Clinia in the following spring and summer. When there is more snow cover in Eurasia in winter, droughts appear in Northern China the following spring and in the Yangtze River valley of China in the following summer. (See also W89-2606) (Author's abstract) W89.02609

PROGRESSION OF REGIONAL SNOW MELT,

Group 2C-Snow, Ice, and Frost

Lamont-Doherty Geological Observatory, Palisades, NY. D. A. Robinson.

D. A. Robinson.

Available from the National Technical Information Service, Springfield, VA 22161, as DE86-011983. Price codes: A12 in paper copy; A01 in microfiche. IN: Snow Watch *85. Glaciological Data Report GD-18. March 1986. p 63-72. 7 fig, 4 ref.

Descriptors: *Snowmelt, *Snow cover, *Albedo, *Satellite technology, *Remote sensing, *Meteorological data collection, Climatology, Maps, Charts.

Snow melt may be accurately monitored by observing time-related variations of surface albedo. When snow is present, regional surface albedo is primarily a function of (1) the physical properties of snow, (2) the fraction of the snow covered of snow, (2) the fraction of the snow covered surface which is unobstructed and (3) the amount of exposed snow-free ground. The second is a function of the height and density of vegetation or other objects protruding through the pack. The most accurate means of obtaining data on regional to continental scales is through the analysis of shortwave satellite imagery in an interactive manner on an image processor by an observer familiar with the studied area. (See also W89-02606) (Author's abstract) 02606) (Author's abstract)

SOOT FROM ARCTIC HAZE: RADIATIVE EF-FECTS ON THE ARCTIC SNOWPACK, Washington Univ., Seattle. Dept. of Atmospheric

Sciences.
S. G. Warren, and A. D. Clarke.
Available from the National Technical Information
Service, Springfield, VA 22161, as DE86-011983.
Price codes: Al2 in paper copy; A01 in microfiche.
IN: Snow Watch '85. March 1986. p 73-77. 2 fig,

Descriptors: *Snow cover, *Albedo, *Arctic, *Soot, *Model studies, *Climatology, Carbon dioxide, Maps, Charts, Snow pack, Solar radiation.

The burning of fossil fuels adds not only CO2 to The burning of fossil fuels adds not only CO2 to the atmosphere but also particulates which are products of incomplete combustion. The small soot particles, which seem to be largely responsible for the absorption of solar radiation in the Arctic haze, are eventually scavenged from the atmosphere and are incorporated in the Arctic snowpack. The effects of these particulates on the snow albedo and the surface radiation budget were examined using a model for radiative transfer in snow. Results showed that small amounts of the impurities in snow can reduce the albedo dramatically in spectral regions where the albedo is high (visible wavelengths). The Arctic-haze soot in the snowpack lengths). The Arctic-haze soot in the snowpack should have an effect on the earth-atmosphere radiation budget comparable to that of Arctic haze in the atmosphere. The effects calculated are based on soot concentrations measured in newly-fallen on soot concentrations measured in newly-tailer snow. The effect of soot during the melting season will be greater than calculated if the soot particles tend to concentrate at the surface of melting snow, as do micron-size dust particles. These effects on absorption of solar radiation do not take into account any feedbacks. There is a positive feedback which would make the effect larger, but which would require a climate model to estimate it. The lower snow albedo could also cause increased melting rates in summer, and cause the snow to disappear sooner than usual, thus uncovering the lower albedo sea ice earlier in the season. (See also W89-02606) (Sand-PTT)
W89-02611

SNOW COVER RECORD IN EURASIA, National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.

J. Foster.
Available from the National Technical Information Available from the National Technical Information Service, Springfield, VA 22161, as DE36-011983. Price codes: A12 in paper copy; A01 in microfiche. IN: Snow Watch '85. Glaciological Data Report GD-18. March 1986. p 79-88. 3 fig, 2 tab, 16 ref.

Descriptors: *Snow cover, *Satellite technology, *Remote sensing, *Meteorological data collection, *Eurasia, *Arctic, Sea ice, Maps, Charts, Climatol-

Eurasia has considerably more of its surface area in northern latitudes than does North America and so its snow cover is more extensive. Trends in the its snow cover is more extensive. Trends in the Northern Hemisphere and Eurasia are thus similar. As a result in any study of hemispheric feedback mechanisms involving snow cover, Eurasia has a greater feedback potential than North America. Satellites have been used to map and measure continental snow cover only since the mid 1960's. If snow cover data can be retrieved from presatellite climatological records, an historical file representing varying snow cover conditions may be used to get a longer estimate of any trend or cycles which may exist. An attempt was made to lengthen the satellite snow cover record in Eurasia by reviewing nast climatological records in Europe lengmen the satellite snow cover record in Eurasia by reviewing past climatological records in Europe and Asia and by examining proxy indices such as Arctic sea ice data. Also, the satellite snow cover record was investigated to determine if there is a correlation between the continental snow cover extent and the number of days of snow cover at several different geographic areas in Eurasia where a winter snow cover does not always occur. Results indicate that while there is a rather weak association between sea ice extent and continental snow cover, a coefficient of determination of .77 exists between the mean number of snow cover days for selected locations in the interior of Eurasia and the continental snow cover extent. It may be possible then to use the mean number of snow oc possible then to use the mean number of show cover days at selected sites in Eurasia prior to the advent of satellite monitoring capabilities as an index of the continental snow covered area. (See also W89-02606) (Author's abstract) W89-02612

DISTRIBUTION OF SNOW COVER IN CHINA, Academia Sinica, Lanzhou (China). Lanzhou Inst. of Glaciology and Cryopedology.

Available from the National Technical Information Available from the National Technical information Service, Springfield, VA 22161, as DE86-011983. Price codes: A12 in paper copy; A01 in microfiche. IN: Snow Watch '85. Glaciological Data Report GD-18. March 1986, p 89-95. 8 fig.

Descriptors: *Snow cover, *Snow depth, *Satellite technology, *China, *Remote sensing, *Meteorological data collection, Air temperature, Climatology, Maps, Precipitation, Seasonal variation

Seasonal snow cover in China is highly variable Seasonal show cover in China is nightly Variable from year to year. As much as 9 million sq km has been occupied by show at some time during the past 35 years. In order to determine the recent characteristics of the show cover, the average number of days with snow on ground and snow depth were analyzed from 1600-2300 stations from depth were analyzed from 1600-2300 stations from the 1951-80 interval. Information on glacier distribution was provided by maps based on aerial surveys and ERTS satellite imagery. Based on this data the snow cover in China is divided into the following regions: (1) The area of permanent snow cover occupies about 50,000 sq km and is limited to mountain glaciers in the west. (2) The area of stable snow cover is defined as having a mean annual number of 60 or more snow days and a standard deviation less than 0.4. In the northernmost parts of China snow may be present for as many as 170 days. (3). Unstable snow cover forms almost every winter with the mean annual number of snow cover days varying between 10-60 and an of snow cover days varying between 10-60 and an interannual variability from 0.4-1.0. (4) The area of irregular snow cover generally occurs in southeast China with the mean annual number of snow days less than 10. Together these two regions occupy 4.8 million sq km. Only 0.55 million sq km of China 4.8 million sq km. Only 0.55 million sq km of China is not affected by snow. Snow depth is generally less than in other parts of the world, the maximum depth in most of the country being about 20 cm. In most of China precipitation falls mainly during the summer while snowfall peaks in the spring and autumn. Maximum snow depth and number of days with snow cover occurs in winter. Various regions studied exhibit a secular trend in the surface air studied exhibit a secular trend in the surface air. studied exhibit a secular trend in the surface air temperature and seasonal snow cover. No relationship is seen between annual precipitation and temperature. (See also W89-02606) (Sand-PTT) W89-02613

SNOW SURVEYING IN CANADA.

Canadian Climate Centre, Downsview (Ontario). For primary bibliographic entry see Field 7B. W89-02614

SNOW COVER IN REAL TIME MONITORING, National Environmental Satellite, Data, and Information Service, Washington, DC. Climate Analy-

C. F. Ropelewski. C. F. Kopeiewsky. Available from the National Technical Information Service, Springfield, VA 22161, as DE86-011983. Price codes: A12 in paper copy; A01 in microfiche. IN: Snow Watch '85. Glaciological Data Report GD-18. March 1986. p 105-108. 3 fig.

Descriptors: *Snow cover, *Meteorological data collection, *Climatology, Time series analysis, Eurasia, North America, Precipitation.

A number of empirical studies and numerical climate models have indicated that the large-scale areal extent of snow cover is a potentially important parameter of the global climate system. Fluctuations in monthly and seasonal continental scale snow cover, monitored both with surface station snow cover, monitored both with surface station data and remote satellite observations, have been linked to temperature and atmospheric circulation anomalies. In light of these studies, the Climate Analysis Center has developed a program to monitor snow cover extent in real time. The results are used qualitatively as aids to the interpretation and diagnosis of anomalies in the monthly temperature. used quantativey as add to the interpretation and diagnosis of anomalies in the monthly temperature, precipitation, and circulation features. Time series of Northern Hemispheric and continental scale snow cover extent and standardized anomaly are also produced monthly. These plots provide useful tools for placing current snow cover fluctuations. also produced monthly. These piots provide userul tools for placing current snow cover fluctuations into historical context, estimating the magnitude of typical snow cover fluctuations, and identifying long term trends in the data. (See also W89-02606) (Author's abstract) W89-02615

NORTHERN HEMISPHERE SNOW AND ICE CHART OF NOAA/NESDIS,

National Environmental Satellite, Data, and Information Service, Washington, DC. T. E. Baldwin.

1. E. Baldwin.
Available from the National Technical Information
Service, Springfield, VA 22161, as DE86-011983.
Price codes: Al2 in paper copy; A01 in microfiche.
IN: Snow Watch '85. Glaciological Data Report
GD-18. Glaciological Data Report GD-18. March
1986. p 109-113. 5 fig.

Descriptors: *Snow cover, *Ice cover, *Satellite technology, *Remote sensing, *Meteorological data collection, Climatology, Maps, Charts.

nce 1966, the Satellite Analysis Branch of the Since 1966, the Satellite Analysis Branch of the National Environmental Satellite, Data, and Information Service (NESDIS) has prepared a weekly snow and ice boundary chart for the Northern Hemisphere. The primary sources of information used in this chart are satellite images from the visible scanning radiometers of the National Oceanic and Autocarbeits (Model). visible scanning radiometers of the National Oceanic and Atmospheric Administration (NOAA) polar-orbiting satellite system. Secondary input comes from the visible scanning radiometers of the Geostationary Satellite (GEOS) systems over the North American continent and occasionally from the Meteorological Satellite (METEOSAT) system. This snow boundary chart is prepared on a 1:50,000,000 polar stereographic base map centered on the North Pole. (See also W89-02606) (Sand-PTT) W89-02616

NOAA SATELLITE-DERIVED SNOW COVER DATA BASE: PAST, PRESENT, AND FUTURE, National Environmental Satellite, Data, and Information Service, Washington, DC.

M. Matson. M. Maison.

Available from the National Technical Information
Service, Springfield, VA 22161, as DE86-011983.

Price codes: A12 in paper copy; A01 in microfiche.
IN: Snow Watch '85. Glaciological Data Report
GD-18. March 1986. p 115-124. 8 ref.

Snow, Ice, and Frost—Group 2C

Descriptors: *Snow cover, *Satellite technology, *Remote sensing, *Meteorological data collection, Climatology, Maps, Charts, History.

The NOAA (National Oceanic and Atmospheric Administration) Northern Hemisphere satellite-derived snow cover data base now includes 20 years of data from 1966-1985. A timeline of the history, use, and future of this data base can be divided into 4 periods: (1) the Age of Darkness, occurring prior to 1974, the year of Kukla and Kukla's first paper about the NOAA satellite snow cover data; (2) the Age of Discovery, following the publication of the 1974 paper; (3) the Age of Enlightenment, beginning in 1980, highlighted by the creation of a digitized data set of the NOAA Northern Hemispheric Weekly Snow and Ice Cover Chart; and (4) the Age of Advancement, to begin with the 1990 launch of a new series of polar-orbiting satellites which will include instrumentation enabling users to discriminate snow from clouds and allow-The NOAA (National Oceanic and Atmospheric ntes which will include instrumentation enabling users to discriminate snow from clouds and allowing snow cover detection through clouds. The highlights of each of these periods is reviewed with the goal of providing a perspective on the evolution of the NOAA snow cover data base. (See also W89-02606) (Sand-PTT) W89-02617

SNOW COVER DATA: STATUS AND FUTURE

PROSPECTS,
Cooperative Inst. for Research in Environmental Science, Boulder, CO.
For primary bibliographic entry see Field 7B.
W89-02618

COMPARISON OF NORTHERN HEMI-SPHERE SNOW COVER DATA SETS, Maryland Univ., College Park. Dept. of Meteorol-

For primary bibliographic entry see Field 7C. W89-02619

INFLUENCE OF SNOW STRUCTURE VARIA-BILITY ON GLOBAL SNOW DEPTH MEAS-UREMENT USING MICROWAVE RADIO-

METRY, National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center. For primary bibliographic entry see Field 7B. W89-02620

RETRIEVAL OF SNOW WATER EQUIVALENT FROM NIMBUS-7 SMMR DATA, Helsinki Univ. of Technology, Espoo (Finland). Dept. of Electrical Engineering. For primary bibliographic entry see Field 7B. W89-02621

NIMBUS-7 SMMR SNOW COVER DATA, National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center. For primary bibliographic entry see Field 7C. W89-02622

SNOW COVER MONITORING USING MICRO-WAVE RADIOMETRY, National Environmental Satellite, Data, and Infor-mation Service, Washington, DC. For primary bibliographic entry see Field 7B. W89-02623

REMOTE SENSING OF SNOW PROPERTIES IN MOUNTAINOUS TERRAIN, California Univ., Santa Barbara.
For primary bibliographic entry see Field 7B.
W89-02624

EFFECTS OF SNOW COVER AND TROPICAL FORCING ON MID-LATTIUDE MONTHLY MEAN CIRCULATION, Maryland Univ., College Park. Dept. of Meteorol-

ogy.
A. Robock, and J. W. Tauss.
Available from the National Technical Information
Service, Springfield, VA 22161, as DE86-011983.

Price codes: A12 in paper copy; A01 in microfiche. IN: Snow Watch; 85. Glaciological Data Report GD-18. March 1986. p 207-214. 2 tab, 14 ref. NOAA Grants NA81AA-H-00023 and NA84AA-H-00026 and NSF Grant ATM-8213184.

Descriptors: *Snow cover, *Atmospheric circulation, *Climatology, Model studies, Simulation, Air temperature.

temperature.

The effect of anomalous snow cover on the monthly mean atmospheric circulation was studied by
incorporating such forcing into the simple, linear,
steady-state climate model of Opsteegh and
Mureau. Anomalous forcing fields of snow cover
were created for three months (October, January
and April) in the snow season for the winters of
1976-82. Anomalous heating fields were also imposed based on observed tropical anomalies of
outgoing longwave radiation. The monthly mean
anomalous circulation patterns were calculated for
each forcing separately and for the combined foreach forcing separately and for the combined foreach forcing separately and for the combined forsamall but positive correlations with the observed
atmospheric circulation. Correlation coefficients
calculated for various regions in the Northern
Hemisphere show that the addition of snow cover
as a forcing mechanism does not produce better
simulations of the monthly mean flow. (See also
W89-02606) (Author's abstract)
W89-02625

PARAMETERIZATION OF SNOW ALBEDO FOR CLIMATE MODELS, Colorado Univ. at Boulder. Dept. of Geography. For primary bibliographic entry see Field 7C. W89-02626

MODELLING A SEASONAL SNOW COVER, Institute of Hydrology, Wallingford (England). E. M. Morris.

E. M. Morris.

Available from the National Technical Information Service, Springfield, VA 22161, as DE86-011983. Price codes: A12 in paper copy; A01 in micrfoiche. IN: Snow Watch '85. Glaciological DAta Report GD-18. March 1986. p 225-240. 3 fig, 15 ref.

Descriptors: *Snow cover, *Snow melt, *Atmosphere, *Carbon dioxide, *Climatology, *Model studies, Simulation, Scotland.

Physics-based, distributed models for snow processes and their potential use in assessing the effects of climatic change produced by increased levels of carbon dioxide in the atmosphere are discussed. The conservation and constitutive equations for snow treated as a three-phase, four-component mixture are described and the simplifications made in the various current distributed models explained. One particular model, the SHE snow component, is used to estimate the sensitivity of predictions of snowmelt rate to variations in meteorological is used to estimate the sensitivity of predictions of snowmelt rate to variations in meteorological inputs using field data from a site in the Cairngorm Mountains of Scotland. This analysis indicates that, for the expected levels of climatic variation, the change in predicted snowmelt rates is of the same order as the uncertainty in these rates arising from uncertainty in one of the parameters of the model, the aerodynamic roughness length. However, field data suggests that it may be possible to specify this parameter more precisely. Given that this can be achieved, the SHE snow routine, and other distributed models which use the aerodynamic roughness or an equivalent parameter, should form a useful component of general models for prediction of the effects of increased carbon dioxide. (See also W89-02666) (Author's abstract) 02606) (Author's abstract) W89-02627

CHARACTERISTICS OF SEASONAL SNOW COVER AS SIMULATED BY GFDL CLIMATE

MODELS, National Oceanic and Atmospheric Administra-tion, Princeton, NJ. Geophysical Fluid Dynamics Lab

A. J. Broccon.
Available from the National Technical Information
Service, Springfield, VA 22161, as DE86-011983.
Price codes: A12 in paper copy; A01 in microfiche.

IN: Snow Watch '85. Glaciological Data Report GD-18. March 1986. p 241-248. 4 fig, 11 ref.

Descriptors: *Snow cover, *Atmospheric circula-tion, *Climatology, *Model studies, Simulation, Sea ice, Temperature, Satellite technology, Remote sensing.

Two climate simulations were performed using an atmospheric general circulation model developed at the Geophysical Fluid Dynamics Laboratory. The model employed for these simulations uses the spherical method, in which the horizontal distribuspherical method, in which the horizontal distribu-tions of atmospheric variables are represented by a limited number of spherical harmonics. The sea-sonally-varying distribution of insolation at the top of the atmosphere was prescribed, along with the climatological distributions of sea surface tempera-ture and sea ice. The snow cover distributions produced in these simulations were compared with satellite observations. Both versions of the model generate snow cover very similar in extent to the observed snow cover. (See also W89-02606) (Au-thor's abstract) thor's abstract) W89-02628

CO2-INDUCED CHANGES IN SEASONAL SNOW COVER SIMULATED BY THE OSU COUPLED ATMOSPHERIC-OCEAN GENERAL CIRCULATION MODEL, Oregon State Univ., Corvallis. Climatic Research

M. E. Schlesinger

M. E. Schlesinger.

Available from the National Technical Information
Service, Springfield, VA. 22161, as DE86-011983.

Price codes: A12 in paper copy; A01 in microfiche.
IN: Snow Watch '85. Glaciological Data Report
GD-18, March 1986. p 249-270. 11 fig. 1 tab, 19 ref.
Department of Energy Grants ATM 8205992 and
ATM 8511889.

Descriptors: *Air pollution effects, *Greenhouse effects, *Snow cover, *Carbon dioxide, *Climatology, Model studies, Simulation, Antarctic, Arctic, Greenland, Air temperature.

Greenland, Air temperature.

Two 20-year simulations were performed with the OSU (Oregon State University) coupled atmosphere/ocean general circulation model that differ only in their CO2 concentrations, one a 1xCO2 simulation with 326 ppmv CO2, and the second a 2xCO2 simulation with 652 ppmv CO2. Averages taken over the last 5 years of the simulations show that there is a CO2-induced increase in the annual mean surface air temperature in both hemispheres and a decrease in the snow cover in each hemisphere. The snow mass decreases in the Northern Hemisphere and increases in the Southern Hemisphere. Poleward of 30 N and equatorward of 68 S the snow mass decreases throughout the year in response to the CO2 doubling, while the snow mass increases poleward of 68 S throughout the year. In contrast to the CO2-induced global warming of the surface air temperature, the snow mass obth decreases and increases over large geographical areas during both December-February and June-August. In winter there is no relation between the snow mass change in the Northern Hemisphere and surface elevation. In summer, Northern Hemisphere locations below 1500 m elevation predominantly have snow mass occur over the Greenland interior in both summer and while higher-altitude surfaces have both increases and decreases. The increases in snow mass occur over the Greenland interior in both summer and winter. In the Southern Hemisphere, the snow mass increases during summer and winter in the interior of Antarctica above the 400 m level and decreases around the Antarctic coastline. The simulations suggest that the monitoring of the snow accumulation rates in Antarctica and Greenland might be of use in the identification of the project climatic change, and in the attribution of this ed climatic change, and in the attribution of this change to the increasing concentration of CO2 and other trace gases. (See also W89-02606) (Sand-PTT) W89-02629

SNOW AND ICE,

Manchester Univ. (England). Dept. of Geography. D. N. Collins.

Group 2C-Snow, Ice, and Frost

IN: Hydrology 2000. International Association of Hydrological Sciences, Inst. of Hydrology, Wallingford, England. IAHS Publication No. 171, 1987. p 35-50, 1 fig. 2 tab.

Descriptors: *Snow, *Ice, *Remote sensing, *Research priorities, Future planning, Glaciology, Hydrologic models, Glaciohydrology, Data acquisition.

Technological developments, and in particular the potential of satellite remote sensing for repetitive altimetry and comparative imagery with wide geographical coverage, will enable many developments in glaciology in the years to 2000, and into the 21st century. Satellite remote sensing methods are unlikely to replace field observations altogether and indeed may point to areas where further ground data collection may be necessary. Ablation stakes and snow pits will continue to be employed. The future will definitely be characterized by attention being given to couplings involving snow and ice. Climate-ice sheet, climate-runoff, ice sheet dynamics-basal boundary layers, climate-sea ice-cean and sliding-subglacial hydrological systems-bedfords are notable interlinkages in which progress is already underway. An emphasis on climate-glacier couplings can be expected to develop throughout the next two decades, with attention to modelling and analysis, with a view to prediction rather than merely to monitoring. Glaciology is embarking on a new phase of data collection with remote sensing playing a major role. This should enable gathering of appropriate data and allow measurements to catch up with theoretical development. Analysis will then have to keep ahead of data acquisition. (See also W89-02717) (Lantz-PTT)

SURFACE TOPOGRAPHY OF THE LOWER PART OF COLUMBIA GLACIER, ALASKA, 1974-81.

1974-91, Geological Survey, Tacoma, WA. L. A. Rasmussen, and M. F. Meier. Available from Books and Open-File Reports Section, USGS, Box 25425, Denver, CO 80225, USGS Professional Paper 1258-E, 1985. 63p, 17 fig, 8 tab, 19 ref, 2 append. (Studies of Columbia Glacier, Alaska)

Descriptors: *Glaciers, *Data acquisition, *Topography, *Alaska, Columbia Glacier, Mapping, Altitude, Aerial photography, Photogrammetry, Modeling, Statistical methods, Approximation method, Interpolation, Error analysis, Ice, Homogeneity, Isotropv.

The method of optimum interpolation was used to get surface altitudes on the nodes of a square grid superimposed over a map of the lower 18 kilometers of Columbia Glacier, a large, grounded, ice-berg-calving glacier near Valdez, Alaska. Vertical aerial photography has been obtained about five times a year since July 1976. For each of 29 flights, the altitude of the glacier surface has been determined photogrammetrically at the locations of prominent surface features. The large amount of data, the noisy character of the topographic data due to the rough surface, and the need to know for modeling precisely how the ice surface changes with time require a sophisticated interpolation procedure. Topographic maps of the glacier surface were obtained from flights on July 27, 1974, and September 1, 1981. The first approximation of the topography on the date of a particular intervening flight is taken to be the linear combination of the two maps that best fits the photogrammetric data from that flight. The deviation of the individual photogrammetric points about this first approximation are the quantities to which the method of optimum interpolation is actually applied in estimating the altitudes of the grid nodes. The statistical properties of the surface topography are described in terms of the correlation between the altitude changes at a point and the changes at some other point. This correlation has a high degree of homogeneity and isotropy, both spatially and temporally, and was little affected by the glacier flow. This remarkable regularity permits the use of a very simple implementation of the optimum interpolation algorithm. The random error in the pho-

togrammetrically determined altitudes is estimated at 3.5 meters by comparing the individual points with maps made from the same flights. A ground-truth sample of 58 individual and averaged points was used to test the interpolated results for three flights. The asymmetry of these sample deviations about the first-approximation surface suggests that there may be a systematic error of about +1.5 meters in the photogrammetrically determined altitudes. The standard error in the altitudes interpolated on the grid nodes is estimated to be 2.5 meters. (See also W89-03022) (Author's abstract) W89-03021)

BED TOPOGRAPHY INFERRED FROM AIR-BORNE RADIO-ECHO SOUNDING OF CO-LUMBIA GLACIER, ALASKA,

Geological Survey, Tacoma, WA. C. S. Brown, L. A. Rasmussen, and M. F. Meier. Available from Books and Open-File Reports Section, USGS, Box 25425, Denver, CO 80225. USGS Professional Paper 1258-G, 1986. 26p, 22 fig. 1 tab, 35 ref. append. (Studies of Columbia Glacier, Alacka).

Descriptors: *Glaciers, *Data acquisition, *Topography, *Remote sensing, *Alaska, *Columbia Glacier, Radio-echo sounding, Aerial surveys, Mapping, Data interpretation, Profiles, Bedrock, Altitude, Error analysis.

The first airborne radio-echo sounding of a temperate glacier was performed in 1978 at Columbia Glacier, a large (1,100-square-kilometer), grounded, iceberg-calving glacier 38 kilometers west of Valdez, Alaska. The sounding system used a low frequency (about 1.5 megahertz) to overcome scatterings from water-filled voids in the ice, a short pulse, and an untuned receiver. Transverse and longitudinal profiles were flown over the lower 7 kilometers of the glacier. The received signal, the horizontal position of the airplane, and its altitude above the glacier surface were recorded by an FM tape recorder. For the data analysis, pictures of received energy from each flight profile were reconstructed from the taped data using an oscilloscope. Use of intersecting profiles allowed an internal consistency check to determine whether the correct bed reflection had been chosen. A three-dimensional geometric method of determining the envelope of the reflection lobes was developed for interpreting the data, instead of the differential method used by previous investigators. This analysis provided bedrock altitude determinations at every node of a 200-meter square grid. The probable error in the inferred bed altitudes was estimated to be 30 meters; the greatest depth was 370 meters below sea level. (See also W89-03021) (Author's abstract)

ROLE OF ICE IN THE MORPHO-SEDIMEN-TOLOGIC REGIME OF A SHORELINE IN THE MIDDLE SAINT LAWRENCE ESTUARY (LE ROLE DES GLACES DANS LE REGIME MORPHO-SEDIMENTOLOGIQUE D'UN ESTRAN DE L'ESTUAIRE MOYEN DU SAINT-LAURENT),

Laval Univ., Quebec. Dept. of Civil Engineering. For primary bibliographic entry see Field 2J.

OPERATIONS FOR AN UNDER-ICE ECOLO-GY PROGRAM,

National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.

For primary bibliographic entry see Field 2H. W89-03179

INFLUENCE OF A RIVER PLUME ON THE SEA-ICE MEIOFAUNA IN SOUTH-EASTERN HUDSON BAY,

Arctic Biological Station, Ste. Anne de Bellevue (Quebec).

For primary bibliographic entry see Field 2L.

MODELLING SEASONALLY FREEZING GROUND CONDITIONS,

GROUND CONDITIONS,
Bristol Univ. (England).
M. G. Anderson, and K. M. Sambles.
Available from the National Technical Information
Service, Springfield, VA 22161, as AD-A190 951.
Price codes: A03 in paper copy, A01 in microfiche.
First Interim Report, July 1987. 25p., 4fig. 2 tal. It ref. Corps of Engineers Contract 45-87-C-0036.

Descriptors: *Frost, *Frozen ground, *Snow cover, *Maps, *Snow, *Distribution patterns, *Model studies, Data interpretation, Snowmelt, Lee

Snow and frozen ground are active agents influencing the landscape of the cold regions (high altitude or high mountain areas) today. Snow accumulates and then melts or compacts. Differential accumulation and melt, due to external climatic and topographical and internal physical factors, cause spatial, temporal, and physical differences in the snowcover. This project attempts to model the spatial distribution of snowcover in areas experiencing seasonally frozen ground. A meltrate 'contour' map can be produced using the meltrates derived. Simple linear interpolation between points will achieve this. The depth of snow is required for a ground temperature model. (See also W89-03383) (Lantz-PTT)

2D. Evaporation and Transpiration

EVAPOTRANSPIRATION OF PHREATO-PHYTES IN THE SAN LUIS VALLEY, COLO-PADO

RADO,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.

Available from the National Technical Information Service, Springfield, VA 22161, as PB88-181086/ AS. Price codes: A06 in paper copy; A01 in microfiche. Colorado Water Resources Research Institute, Fort Collins. Technical Report No. 48, June 1987. 107p, 25 fig, 26 tab, 59 ref, 4 append. (M.S. Thesis). Contract No. 14-08-0001-G895 and 14-08-0001-G1006. Project No. USGS G895-06 and G1006-06

Descriptors: *Phreatophytes, *Evapotranspiration, *Groundwater level, *Consumptive use, San Luis Valley, Colorado, Greasewood, Rabbitbrush, Saltgrass.

The San Luis Valley of south-central Colorado contains a hydrologically closed basin within which a water salvage project has been planned and is partly in operation. This project's goal is to pump water from the unconfined (water table) aquifer which would otherwise be lost through evapotranspiration (ET) from the native rangeland. In order to determine the proper design pumping rate (which will affect subsequent water table drawdown), an accurate estimate of the water use of these plants must be obtained. The basic purposes of this research were: to further develop and apply gas analysis technology for making ET measurements from phreatophytes; to compare these measurements with measurements of ET taken from U.S. Bureau of Reclamation (USBR) lysimeters operating in the same area; and to observe the trends in ET for several different water table depths and drawdown conditions. Measurement of ET in this area was carried out using the chamber method during several periods of 1985 and 1986. Measurements were made of greasewood (Sarcobatus vermiculatus Hook. Torr.), and salt grass (Distichilis stricta L. Greene) since these plants constitute the major indigenous vegetation of the Closed Basin plant community. At a site of continuous pumping the greasewood plots appeared to suffer a reduction in ET, whereas the abbitrush plots exhibited no detectable reduction in ET from the same water table drawdown. There appear to be no substantial differences in the ET of greasewood and rabbitorush plots between two sites where the groundwater levels have historically been 1.25 meters (m) and 4.3 m. Bare soil evaporation decreased with increasing depth to water table. Bare soil contributes significantly to

Streamflow and Runoff-Group 2E

the total ET of greasewood and rabbitbrush plots the total E1 of greasewood and rabolitoriush piots in areas of shallow water table (1.25 m). A direct comparison shows that USBR lysimeters accounted for only 40 percent of the mean total salt grass ET measured by the chamber over a period of 77 days. Additional discrepancies in ET measured by the USBR lysimeters and the Chamber at the same the control same site indicate possible erroneous estimates of ET by the former for undisturbed vegetation in the surrounding plant community. (See also W89-02481) (USGS) W89-02478

EVAPOTRANSPIRATION OF NATIVE VEGETATION IN THE CLOSED BASIN OF THE SAN LUIS VALLEY, COLORADO, Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering. F. L. Charles, J. A. Morgan, and W. C. Bausch. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-181078/AS. Price codes A04 in paper copy; A01 in microfiche. Colorado Water Resources Research Institute, Fort Collins, Completion Report No. 143, June 1987. 52p, 24 fig. 5 tab. 13 ref, append. Contract No. 14-08-0001-G895 and 14-08-0001-G1006. Project No. USGS G895-06 and G1006-06.

Descriptors: *Phreatophytes, *Evapotranspiration, *Groundwater level, *Consumptive use, San Luis Valley, Colorado, Greasewood, Rabbitbrush, Salt

The Closed Basin project in the San Luis Valley of south-central Colorado is a water salvage project now under construction. Its objective is to pump and salvage water from the unconfined (water table) aquifer which would otherwise be lost through evapotranspiration (ET) from native vege-tation. In order to determine the proper pumping tation. In order to determine the proper pumping rate to lower the water table correctly, an accurate estimate of the ET of these plants must be obtained. The purposes of this research were: (1) to further develop and apply gas analysis technology for measuring ET from native vegetation; (2) to obtain ET measurements on representative plants; (3) to compare these measurements with measurements of ET takes fear 11.5 Puzzu of Peodersents of ET nts of ET taken from U.S. Bureau of Reclamaments of E1 taken from U.S. Bureau of Reciama-tion (USBR) lysimeters operating in the same area; and (4) to observe the trends in ET for several different water table depths. Measurements of ET different water table depths. Measurements of E1 of native vegetation were carried out using the gas analysis chamber method during several periods of 1985 and 1986. Measurements were made of greasewood (Sarcobatus vermiculatus Hook. Torr.), rabbitbrush (Chrysothamnus nauseosus Pall. Britt.), and salt grass (Distichlis stricta L. Greene). These plants constitute the major indigenous vegetation of the closed basin plant community. Both plants showed reduced ET when the water table was lowered below 4.8 meters. There no substantial differences in the ET of greasewood and rabbitbrush at sites where the groundwater levels have been constant historically at either 1.25 meters (m) or 4.3 meters. Measurements on bare soil indicate a decrease in evaporation with an increase in depth to water table. It was also found increase in depth to water table. It was also found that evaporation from bare soil contributes signifi-cantly to the total ET of greasewood and rabbit-brush in areas of shallow water table (1.25m). (See also W89-02478) (USGS) W89-02481

EVAPOTRANSPIRATION RATES AT SELECTED SITES IN THE POWDER RIVER BASIN, WYOMING AND MONTANA, Geological Survey, Cheyenne, WY. Water Re-

sources Div

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 82-4105, 1987. 23p, 9 fig, 17 tab, 11 ref.

Descriptors: *Evapotranspiration, *Phreatophytes, *Wyoming, *Montana, Groundwater, Alluvium, Powder River basin, Blaney-Criddle method, Northern Great Plains.

Twelve sites were chosen for a study of evapotranspiration in the Powder River basin based on variations in topography and plant communities, geo-

graphic location, and the availability of groundgraphic location, and the availability of ground-water data at the sites. Evapotranspiration rates were estimated from groundwater, meteorological, and vegetation data using the Blaney-Criddle method. Five of the sites were equipped with digital recorders that provided continuous ground-water level data at the sites for the 1978 growing season. Evapotranspiration was estimated monthly during the growing season and ranged from 0 to 3.7 inches per month. Total evapotranspiration 3.7 inches per month. Total evapotranspiration rates for the growing season ranged from 8.3 to 14.9 inches. Discharge per mile of stream reach was estimated for three of the sites and ranged from 0.03 to 0.31 cubic foot per second. The well records for the remaining seven sites consisted of recorbly collections. monthly, or less frequent, water-level measure-ments. Evapotranspiration rates estimated for those ments. Evapotranspiration rates estimated for those months for which water-level data were available ranged from 0 to 3.8 inches per month. Only one of these sites had monthly water-level measurements for the entire growing season; a total of 9.7 inches of evapotranspiration was estimated for the growing season at this site. (USGS)

DETERMINATION OF EVAPORATION AND SEEPAGE LOSSES, UPPER LAKE MARY NEAR FLAGSTAFF, ARIZONA,

Geological Survey, Tucson, AZ. Water Resources

For primary bibliographic entry see Field 2H. W89_02558

INFLUENCE OF POTENTIAL EVAPORATION ON THE VARIABILITIES OF SIMULATED SOIL WETNESS AND CLIMATE, National Oceanic and Atmospheric Administration, Princeton, NJ. Geophysical Fluid Dynamics

T. L. Delworth, and S. Manabe. Journal of Climate, Vol. 1, No. 5, p 523-547, May 1988. 15 fig, 4 tab, 25 ref, 2 append.

Descriptors: *Potential evaporation, *Remote sensing, *Evaporation, *Climates, *Model studies, *Soil water, *Atmospheric water, *Air-earth interface, Long-term studies, Temoral variability.

An atmospheric general circulation model with prescribed sea surface temperature and cloudiness was integrated for 50 years to study atmosphereland surface interactions. The temporal variability of model soil moisture and precipitation has been studied in an effort to understand the interactions of these variables with other components of the climate system. Temporal variability analysis has shown that the spectra of monthly mean precipita-tion over land are close to white at all latitudes, non over and are close to white at all latitudes, with total variance decreasing poleward. In contrast, the spectra of soil moisture are red and become more red with increasing latitude. As a measure of this redness, half of total variance of a composite tropical soil moisture spectrum occurs at periods longer than nine months, while at high tudes, half of the total variance of composite soil moisture spectrum occurs at periods longer than 22 months. The spectra of soil moisture also exhibit marked longitudinal variations. Through the use of a second general circulation model inte gration with prescribed soil moisture, it was shown that interactive soil moisture may substantially increase summer surface air temperature variability. Soil moisture interacts with the atmosphere primarily through the surface energy balance. The degree of soil saturation strongly influences the degree of soil saturation strongly influences the partitioning of outgoing energy from the surface between the latent and sensible heat fluxes. Interactive soil moisture allows larger variations of these fluxes, thereby increasing the variance of surface air temperature. Because the flux of latent heat is directly proportional to potential evaporation under conditions of sufficient moisture, the influence of soil moisture on the atmosphere is greatest when the potential evaporation value is large. This occurs most frequently in the tropics and summer hemisphere extratropics. (Author's abstract) hemisphere extratropics. (Author's abstract) W89-03308

2E. Streamflow and Runoff

FIELD STUDY OF EPHEMERAL STREAM-AQUIFER INTERACTION,
New Mexico Inst. of Mining and Technology,
Socorro. Dept. of Geoscience.
For primary bibliographic entry see Field 2F.
W89-02349

EPHEMERAL RUNOFF AND GROUNDWAT-ER RECHARGE, New Mexico Univ., Albuquerque. Dept. of Civil For primary bibliographic entry see Field 2F. W89-02350

BLOUNTSTOWN REACH, APALACHICOLA RIVER, MOVABLE-BED MODEL STUDY, Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab. For primary bibliographic entry see Field 2J. W89-02416

JEFFERSON BARRACKS BRIDGE, MOVA-BLE-BED MODEL STUDY. bibliographic entry see Field 2J.

HYDROLOGY IN PRACTICE, Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering. For primary bibliographic entry see Field 2A. W89-02421

SEDIMENT TRANSPORT IN GRAVEL-BED RIVERS Queen Mary Coll., London (England). For primary bibliographic entry see Field 2J. W89-02430

DIFFERENCES BETWEEN GRAVEL AND SAND-BED RIVERS, Simons and Associates, Inc., Fort Collins, CO. For primary bibliographic entry see Field 2J. W89-02431

RIVER DYNAMICS, FLOW REGIME AND SEDIMENT TRANSPORT, University of East Anglia, Norwich (England). School of Environmental Sciences. For primary bibliographic entry see Field 2J. W89-02432

SEDIMENT SUPPLY TO UPLAND STREAMS: INFLUENCE ON CHANNEL ADJUSTMENT, Liverpool Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2J. W89-02435

TRANSPORT PROCESSES AT THE CATCH-IRANSPURT PROCESSES AT THE CATCH-MENT SCALE, Institute of Hydrology, Powys (Wales). Fluvial Geomorphology Unit. For primary bibliographic entry see Field 2J. W89-02437

SEDIMENT BALANCE CONSIDERATIONS LINKING LONG-TERM TRANSPORT AND CHANNEL PROCESSES, Northwest Hydraulic Consultants Ltd., Edmonton For primary bibliographic entry see Field 2J. W89-02438

STATIC ARMOUR LAYERS BY SELECTIVE EROSION,
Canterbury Univ., Christchurch (New Zealand).
Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W89-02439

Group 2E-Streamflow and Runoff

FIELD MEASUREMENTS IN A GRAVEL-BED RIVER WHICH CONFIRM THE THEORY OF

RIVER WHICH CONFIRM THE THEORY OF WHITE ET AL., Ministry of Works and Development, Christ-church (New Zealand). Hydrology Centre. For primary bibliographic entry see Field 2J. W89-02446

MOUNTAIN TORRENT EROSION, Kyoto Univ. (Japan). Disaster Prevention Re-For primary bibliographic entry see Field 2J.

ENERGY DISSIPATION RATE APPROACH IN RIVER MECHANICS, Bureau of Reclamation, Denver, CO. Engineering and Research Center.

For primary bibliographic entry see Field 2J. W89-02453

EXTREMAL HYPOTHESES APPLIED TO RIVER REGIME,

Hydraulics Research Ltd., Wallingford (England). For primary ibiliographic entry see Field 2J. W89-02454

PROBLEMS OF BED LOAD TRANSPORT IN BRAIDED GRAVEL-BED RIVERS, Lincoln Coll., Canterbury (New Zealand). Dept. of Agricultural Engineering. For primary bibliographic entry see Field 2J. W89-02455

INTERACTION OF BED LOAD TRANSPORT WITH BARS

WILL DARS, Eidgencessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie. For primary bibliographic entry see Field 2J. W89-02456

TIME-VARYING STOCHASTIC MODEL OF THE FREQUENCY AND MAGNITUDE OF BED LOAD TRANSPORT EVENTS IN TWO SMALL TROUT STREAMS,

Biological Association, Ambleside (England). For primary bibliographic entry see Field 2J. W89-02459

MODELLING FLUVIAL PROCESSES IN STREAMS WITH GRAVEL MINING,
San Diego State Univ., CA. Dept. of Civil Engineering. H. H. Chang.

IN: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 977-988,

Descriptors: *Model studies, *Mining effects, *Mathematical models, *Channel morphology, *Alluvial channels, *Channel erosion, Sediment transport, Channel scour, Sediment load, Streamflow, Environmental effects, Bed load, Sedimentation, Gravel, Fluvial sediments

The application of a mathematical model in evaluating stream channel changes induced by gravel mining is described. Analytically, the model employs, in addition to the ordinary physical relations governing the flow and sediment transport processes, the concept that an alluvial stream is constantly seeking to establish equal power expenditure per unit channel length. If the energy gradient is approximated by the water surface slope, then uniform power expenditure is convergent to a is approximated by the water surface stope, then uniform power expenditure is equivalent to a straight water surface profile. Based upon this concept, channel width adjustment is such that the water surface profile is effectively approached. While equal power expenditure along the channel is the direction toward which each stream channel evolves, the adjustment in channel width under the contraction of the channel width under the contraction of t this condition is not necessarily toward streamwise uniformity even if the roughness is constant. It is illustrated that uniform power expenditure is some-

times accomplished by significant streamwise variation in width. A physical example also shows that, even in the vicinity of a gravel pit, the time variation in width can be much greater than the associated change in channel bed elevation. (See also W89-02430) (Author's abstract)

SEEPAGE STUDY OF A 15,3 MILE SECTION OF THE CENTRAL UTAH CANAL, PAHVANT VALLEY, MILLARD COUNTY, UTAH, Geological Survey, Salt Lake City, UT.

M. Enright. Available from OFSS, USGS, Box 25425, Denver, CO 80225. Utah Dept. of Natural Resources Tech Pub. 91, 1987. 24p, 3 fig, 3 tab, 2 ref.

Descriptors: *Canals, *Utah, *Seepage, Water loss, Central Utah Canal, Pahvant Valley.

Three sets of seepage measurements were made at ten canal sites and at all turnouts along a 15.3-mile section of the Central Utah Canal during the summer of 1986. The total loss for the 15.3-mile section averaged about 36 cubic feet per second or 2.4 cubic feet per second per mile. The nine subsections were grouped into five reaches of one or more subsections with similar losses per mile. Average losses for these five reaches ranged from 0 to 4.1 cubic feet per second per mile. No average gains were detected. (USGS) W89-02469

STATISTICAL ANALYSES OF FLOOD FREQUENCY, LOW-FLOW FREQUENCY AND FLOW DURATION OF STREAMS IN THE PHILADELPHIA AREA, PENNSYLVANIA, Geological Survey, Harrisburg, PA. Water Resources Div.

A. Voytik. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 85-4008, 1986, 34p, 9 fig, 3 tab, 6 ref.

Descriptors: *Flood frequency, *Low flow, *Flow duration, *Pennsylvania, *Statistics, Streamflow forecasting, Philadelphia, Wissahickon Creek.

Flood frequency, low-flow frequency and flow-duration analyses were computed for 26 stream-gaging stations in and near Philadelphia, Pennsyl-vania. Data were obtained from 21 continuousrecording stations and five stations that were inirecording stations and five stations that were initially continuous-recording stations, but which were subsequently converted to crest-stage stations. The annual peak flows were fitted to a three-parameter log-Pearson Type III distribution to develop flood-flow-frequency curves. The range of annual excedance probabilities for flood-frequency distributions will vary depending on record length. Daily discharges for all stations that had five or more years of record were statistically analyzed by digital computer. Low-flow frequency analyzed by digital computer. Low-flow frequency and flow-duration data for these stations are pre-sented in tabular form. (USGS) W89-02492

HISTORY OF ANNUAL STREAMFLOWS FROM THE 21 WATER RESOURCES RE-GIONS IN THE UNITED STATES AND PUERTO RICO, 1951-83, Survey, Madison, WI. Water Re-

sources Div. For primary bibliographic entry see Field 7C. W89-02493

DISCHARGE RATINGS FOR CONTROL STRUCTURES AT MCHENRY DAM ON THE FOX RIVER, ILLINOIS,

Geological Survey, De Kalb, IL. Water Resources

For primary bibliographic entry see Field 7B. W89-02494

METHOD FOR DELINEATING FLOOD-PRONE AREAS IN THE GREAT BASIN OF NEVADA AND ADJACENT STATES, Geological Survey, Carson City, NV. Water Re-

D. E. Burkham.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Supply Paper 2316, 1988. 20p, 2 fig, 1 tab, 58 ref.

Descriptors: *Floods, *Flood frequency, *Flood profiles, *Flood stages, *Flood mapping methods, *Flood hazards, *Great Basin, Alluvial fans, Ephemeral streams, Discontinuous channels, Incised channels. Mountain chang

The Great Basin, a region having no surface drainage to the ocean, encompasses about 210,000 square miles in and adjacent to Nevada. The area is characterized by many north-trending mountain ranges and intervening valleys. Stream channels within the mountains usually are well defined and steep. Many of the mountain streams diverge into numerous distributary channels upon reaching the alluvial fan at the canyon mouth. Others are discontinuous near the apex of the fan, or are deply entrenched in the alluvial deposits. Larger rivers normally have well defined channels to or across the valley floors; however, they all terminate at a lake or playa. Major floods can result from snow-melt, frontal rain, and frontal rain on snow, and convective rainfall during localized thunderstorms. Dominant flood hazards involve inundation by water, high-flow velocities, erosion, and inundation by determined. The Great Basin, a region having no surface drain water, high-flow velocities, erosion, and inunda-tion by debris. The evaluated methods for delineating flood-prone areas are grouped into five general categories-detailed, analytical, physiographic, his-torical, and reconnaissance-that range in level of sophistication from comprehensive to approximate. sophistication from comprehensive to approximate. The suitability of each method depends on the specific types of physiographic setting and flood hazard involved, the mapping accuracy desired, and the data and funding available. (USGS)

HYDROLOGY OF AREA 59, NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES, COLORADO AND WYO-

Geological Survey, Lakewood, CO. Water Re-

N. G. Gaggiani, L. J. Britton, and D. R. Minges. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 85-153, 1987. 124p, 64 fig. 5 tab, 212 ref.

Descriptors: *Coal mining, *Lignite, *River basins, Descriptors: "Oan mining, "Lignite," Aver basins, "Geohydrology, "Water quality, "Areal hydrogeo-logy, "Climates, "Colorado, "Wyoming, "South Platte River Basin, Topography, Areal precipita-tion, Areal hydrogeology, Annual floods, Soil clas-sification, Stream classification, Aquifer systems, Rocky Mountains, Front Range, Laramie Moun-tains, Northern Great Plains.

A nationwide need for hydrologic information in coal-mined areas and potential coal development areas was identified with the enactment of the Surface Mining Control and Reclamation Act of 1977 (Public Law 95-87). This report, one in a series of nationwide coal province reports, presents information thematically by describing single hydrologic topics through the use of brief texts and accompanying maps, graphs, or other illustrations. The report broadly characterizes the hydrology of Area 59 in north-central Colorado, and southeastern Wyomjun. The report area located within the The report broadly characterizes the hydrology of Area 59 in north-central Colorado, and southeastern Wyoming. The report area, located within the South Platte River basin, covers a 16,000 square mile area of diverse geology, topography and climate. This results in contrasting hydrologic characteristics. (USGS) W89-02501

ROUGHNESS COEFFICIENTS FOR DENSELY VEGETATED FLOOD PLAINS, Geological Survey, Reston, VA. Water Resources

G. J. Arcement, and V. R. Schneider. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 83-4247, 1987. 62p, 33 fig. 6 tab, 50 ref.

Descriptors: *Roughness coefficient, *Mannings equation, *Channel morphology, *Flood plains,

*Flow resistance, *Hydraulic roughness, Channel flow, Hydraulic friction, Overland flow, Vegeta-tion effects, Louisiana, Mississippi, Alabama.

Although much research has been done on Man-ning's roughness coefficients for stream channels, very little has been done on the selection of rough-ness values for densely vegetated flood plains. In this report four method for determining roughness coefficients for flood plains are examined and evaluated. Field data were collected at 13 sites on wide, densely vegetated flood plains where verified n values were known. The 'vegetation density' of representative sample areas was measured at each site for use in determining roughness coefficient. The vegetation density of the control of t cients. The vegetation density method, proved to be useful in determining n values for wide, densely be useful in determining in values for wine, densely wooded plains. By measuring the area occupied by tree trunks and vegetation in a representative sample area, the vegetation density can be determined. Using the vegetation density in an equation developed from Manning's formula, the Manning's n can be determined for the representative sample area. (USGS) W89-02502

TECHNIQUES FOR ESTIMATING REGIONAL FLOOD CHARACTERISTICS OF SMALL RURAL WATERSHEDS IN THE PLAINS REGION OF EASTERN COLORADO,

Geological Survey, Denver, CO. Water Resources

Div. R. K. Livingston, and D. R. Minges. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Sources Investigations Report 87-4094, 1987. 72p, 18 fig, 19 tab, 59 ref.

Descriptors: "Storm runoff, "Rainfall-runoff relationships, "Small watersheds, "Model studies, "Frequency analysis, "Hydrograph analysis, "Simulation analysis, "Bridge design, Thunderstorms, Regression analysis, Synthetic hydrology, Computer models, Surface runoff, Precipitation excess, Rainfall intensity, Antecedent precipitation, Culverts, Road design, Rain gages, Stream gages.

Recorded and synthetic flood data for 52 water-sheds (35 in Colorado and 17 in adjoining States) sheds (35 in Colorado and 17 in adjoining States) were analyzed to develop regional techniques for estimating the magnitudes, frequency, volume, and hydrograph shape of floods that typically occur on small rural watersheds in the plains region of eastern Colorado. The analysis of flood magnitude and frequency included 21 flood-frequency relations that were based on recorded annual peak discharges, 2 flood-frequency relations that were based on synthetic annual peak discharges, annual peak discharges (a relation could not be determined for one watershed). Similarily, the analysis of flood volume included volumes for 103 recorded floods and 4 391 synthetic floods. Synthetic of flood volume included volumes for 103 record-ed floods and 4,391 synthetic floods. Synthetic flood data were generated from long-term rainfall data from National Weather Service stations and a rainfall-runoff model calibrated from each water-shed. The 5-, 10-, 25-, 50-, and 100-year peak discharges were regionalized using ordinary leastdischarges were regionalized using ordinary least-squares and generalized least-squares regressions. The smallest errors of prediction were obtained using the generalized least-squares regressions, and the relations developed included the independent variables of effective drainage area, relief factor, and 24-hour, 100-year rainfall intensity; standard errors of prediction ranged from 35 to 50 percent. errors of prediction ranged from 35 to 50 percent. A relation was developed to estimate flood volume from peak discharge; the standard error of prediction was 78 percent. To develop a flood hydrograph from estimates of peak discharge and flood volume, a dimensionless-hydrograph technique is presented that produces synthetic flood hydrographs very similar in shape to recorded flood hydrographs. (USGS) W89-02507

TECHNIQUE FOR ESTIMATING FLOOD-PEAK DISCHARGE AND FREQUENCIES ON RURAL STREAMS IN ILLINOIS, Geological Survey, Urbana, IL. Water Resources

Div. G. W. Curtis.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations

Report 87-4207, 1987. 84p, 9 fig, 5 tab, 26 ref.

Descriptors: *Flood peak, *Flood frequency, *Estimating equations, *Peak discharge, Regional analysis, Hydrologic equations, Flood discharge, Flood recurrence interval, Flow characteristics, Basin characteristics, Frequency analysis, Regression analysis, Peak flow, Flood flow, Flow, Streamflow, Storm runoff, Surface runoff, Floods, Hydrology, Streams, Illinois, Gaging stations.

Flood-peak discharges and frequencies are presented for 394 gaged sites in Illinois, Indiana, and Wisconsin for recurrence intervals ranging from 2 to 100 years. A technique is presented for estimatto 100 years. A technique is presented for estimating flood-peak discharges at recurrence intervals ranging from 2 to 500 years for nonregulated streams in Illinois with drainage areas ranging from 0.02 to 10,000 square miles. Multiple-regression analyses, using basin characteristics and peak streamflow data from 268 of the 394 gaged sites, were used to define the flood-frequency relation. The most significant independent variables for estimating flood-peak discharge are drainage area, slope, rainfall intensity and a regional factor. Examples are given to show a step-by-step procedure in calculating a 50-year flood for a site on an ungaged stream, a site at a gaged location, and a site near a gaged location. (USGS)

DRAINAGE AREAS IN THE JAMES RIVER BASIN IN EASTERN SOUTH DAKOTA, Geological Survey, Huron, SD. Water Resources

For primary bibliographic entry see Field 7C. W89-02515

VERTICAL PROFILES OF VELOCITY AND SUSPENDED SEDIMENT IN STREAMS NEAR MOUNT ST. HELENS, WASHINGTON, Geological Survey, Vancouver, WA. Water Resources Div.

For primary bibliographic entry see Field 2J. W89-02523

WATER RESOURCES INVESTIGATIONS IN TENNESSEE: PROGRAMS AND ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY, 1987-

Geological Survey, Nashville, TN. Water Re-For primary bibliographic entry see Field 7C. W89-02559

EFFECTS OF FLUCTUATING RIVER-POOL STAGES ON GROUNDWATER LEVELS IN THE ADJACENT ALLUVIAL AQUIFER IN THE LOWER ARKANSAS RIVER, ARKANSAS, Geological Survey, Little Rock, AR. Water Resources Div.

For primary bibliographic entry see Field 2F. W89-02561

HYDROLOGIC RECONNAISSANCE OF THE HYDROLOGIC RECONNAISSANCE OF THE CHILKAT RIVER BASIN, SOUTHEAST ALASKA (WITH SPECIAL REFERENCE TO THE BALD EAGLE CRITICAL HABITAT AT THE TSIRKU RIVER ALLUVIAL FAN), Geological Survey, Anchorage, AK. Water Re-sources Div

Solutes DAV.

E. F. Bugliosi.

Available from OFSS, USGS, Box 25425, Denver,
CO 80225. USGS Water Resources Investigations
Report 88-4023, 1988. 38p, 25 fig. 6 tab, 15 ref.

Descriptors: *Hydrologic data, *Data collections, *Alaska, *Chilkat River, *Tsirku River, Springs, Birds, Bald eagles, Low flow, Alluvial fan, Stream-

The Chilkat River basin in southeast Alaska is characterized by rugged, highly dissected mountains with steep-gradient streams, braided rivers in broad alluvium-filled valleys, and numerous glaciers. A wide seasonal range in temperature and strong orographic effects cause variations in the amount and distribution of precipitation, and thus

Streamflow and Runoff-Group 2E

in the resulting runoff and streamflow. Streamflow is lowest in winter, when precipitation at higher altitudes is stored as snow, and greatest in summer, altitudes is stored as snow, and greatest in summer, when melting snow and glacier ice augment flow. Groundwater seeps and springs flowing from alluvial fans contribute to streamflow year round. A groundwater discharge zone of particular interest is that along the toe of the Tsirku River alluvial fan, 20 miles north of Haines. During winter, the relatively warm (4 to 6 degrees Celsius) groundwater maintains open leads in a reach of the Chilkat River downstream from the fan. This ice-free reach provides favorable spawning habitat for a reach provides favorable spawning habitat for a late run of chum and coho (silver) salmon, which nate run of chum and cono (silver) salmon, which in turn attracts the world's largest concentration of bald eagles (more than 3,000 birds). The principal source of recharge to the groundwater system in the fan is infiltration from the Tsirku River. Surface and groundwaters are chemically similar, calcium bicarbonate types. All stream samples had dissolved-solids concentrations of less than 115 assolved-solids concentrations of less than 115 milligrams per liter, values for groundwater were slightly greater. During high summer flows, the suspended-sediment concentrations of the glacially fed Chilkat, Tsirku, and Klehnin Rivers ranged from 361 to 1,530 milligrams per liter (6,360 to 22,300 tons per day). (USGS)

WATER RESOURCES INVESTIGATIONS IN TENNESSEE: PROGRAMS AND ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY, 1987-

Geological Survey, Nashville, TN. Water Resources Div.

For primary bibliographic entry see Field 9C.

WATER RESOURCES ACTIVITIES OF THE U. GEOLOGICAL SURVEY IN TEXAS - FISCAL S. GEOLOG YEAR 1987,

Geological Survey, Austin, TX. Water Resources For primary bibliographic entry see Field 9C. W89-02574

WATER LEVEL MEASUREMENTS 1981-85 AND CHEMICAL ANALYSES 1978-85, RED RIVER ALLUVIAL AQUIFER, RED RIVER VALLEY, LOUISIANA,

Geological Survey, Alexandria, LA. Water Resources Div.

For primary bibliographic entry see Field 7C. W89-02582

RAINFALL-RUNOFF DATA FOR SOMERSET COUNTY, NEW JERSEY,

Geological Survey, Trenton, NJ. Water Resources Div. J. B. Campbell.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-384, 1987. 161p, 11 fig, 1 tab, 12 ref.

Descriptors: *New Jersey, *Rainfall, *Stream discharge, *Urban runoff, *Storm runoff, *Rainfall-runoff relationships, Urbanization, Rainfall rate, Flood peak, Somerset County.

Rainfall-runoff data are presented for eight urbanizing drainage basins in Somerset County, New Jersey, for the 1980 through 1984 water years. In order to improve the existing methods for estimat-ing flood-frequency and magnitude throughout the county, and to assist the county in their flood-monitoring efforts by providing real-time data, rainfall-runoff data were collected and a data base rainfail-runoff data were concetted and a data oase was created. The rainfall-runoff data were recorded at 5-minute intervals and were stored in the U.S. Geological Survey, New Jersey District computer. Rainfall data were collected at two sites within each drainage basin in order to improve areal coverage and data continuity. Data from eight rainfall-runoff gaging stations and eight auxil-iary rainfall gages are summarized in this report. Rainfall and runoff data for selected storms also are summarized. (USGS)

Group 2E—Streamflow and Runoff

HYDROLOGIC DATA FOR URBAN STUDIES IN THE AUSTIN METROPOLITAN AREA, TEXAS, 1986,

Geological Survey, Austin, TX. Water Resources Div For primary bibliographic entry see Field 4C. W89-02597

COMPUTER-PROGRAM DOCUMENTATION OF AN INTERACTIVE-ACCOUNTING MODEL TO SIMULATE STREAMFLOW, WATER QUALITY, AND WATER-SUPPLY OPERATIONS IN A RIVER BASIN, Geological Survey, Denver, CO. Water Resources

For primary bibliographic entry see Field 7C. W89-02600

ANNUAL YIELD AND SELECTED HYDRO-LOGIC DATA FOR THE ARKANSAS RIVER BASIN COMPACT, ARKANSAS-OKLAHOMA, 1987 WATER YEAR, Geological Survey, Little Rock, AR. Water Re-sources Div.

N. A. Moore, T. E. Lamb, and L. D. Hauth. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 88-301, 1988. 1 fig, 3 tab, 3 ref.

Descriptors: *Interstate compacts, *Hydrologic data, *Streamflow, *Arkansas, *Oklahoma, Stream discharge, Reservoir storage, Annual vield, River basin. Water quality.

The computed annual yield and deficiency of the subbasins are defined in the Arkansas River Compact, Arkansas-Oklahoma, are given in tables. Actual runoff from the subbasins and depletion Actual runoff from the subbasins and depletion caused by major reservoirs in the compact area are also given in tabular form. Monthly, maximum, and mean discharges are shown for the 14 streamflow stations used in computing annual yield. Water quality data are shown for two sites in the compact area. (USGS) W39-02602

SYNOPTIC-SCALE ASSESSMENT OF SUR-FACE RUNOFF,

Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
D. A. White, G. W. Petersen, J. R. Eyton, and C.

G. Knight. Available from the National Technical Information Service, Springfield, VA. 22161, as DE87-008613. Price codes: A07 in paper copy, A01 in microfiche. Report No. DOE/ER/602, February 1987. Final Report for Period July 1, 1984-September 30, 1986. 123p, 17 fig. 7 tab, 30 ref, 4 append. DOE Grant DE-FG02-84ER60262.

Descriptors: *Runoff forecasting, *Surface runoff, *Land use, *Mathematical studies, *Mahantango Creek, *Synoptic analysis, Hydrologic studies, Rainfall-runoff relationships, Pennsylvania, Errors.

The development and validation of a methodological approach to predicting surface runoff over large regions is considered. The Soil Conservation Service runoff curve number procedure was modified to allow for areal variation of land use and land cover, soils, and rainfall over a regular-gridded network. Ten rainfall events, from the period 1973-1980, were selected to estimate runoff for the Mahantango Creek watershed (162 sq mi) in south-central Pennsylvania. It was found that in large central Pennsylvania. It was found that in large magnitude events, runoff was severely underestimated, while in smaller events both over- and underestimation occurred. Error sources arising from both data input and model structure are qualitatively assessed. It is concluded that the synoptic methodology is useful for providing an initial assessment of high runoff areas for further detailed hydrologic investigation. (Author's abstract) W89-02703

PRE-FEASIBILITY ON STREAMFLOW GAUG-ING USING RADIOISOTOPE TRACER METHOD FOR KEMUMBU AGRICULTURE DEVELOPMENT AUTHORITY (KADA),

Unit Tenaga Nuklear, Bangi (Malaysia). D. B. Mohamad. Available from the National Technical Information Service, Springfield, VA. 22161, as DE87-701735. Price codes: A02 in paper copy, A01 in microfiche. Report No. PPA/CR/6, February 1983. 12p, 1 fig,

Descriptors: *Streamflow, *Gaging, *Radioactive tracers, *Tracer studies, *Radioisotopes, *Data ac-quisition, Irrigation canals, Mixing, Stream flow, Flow profiles, Fluorescein dye, Kelantan River, Malaysia, Stream gages.

Streamflow measurements using isotope dilution techniques were proposed for the Kelantan River and irrigation canals under the Kemubu Agriculand irrigation canais under the kemioti Agricul-ture Development Authority scheme (Malaysia). The success of this experiment depends largely on the achievement of the so-called 'good mixing' conditions of tracers. If good mixing conditions do conditions of tracers. It good mixing conditions do not exist, the results obtained may be erroneous. It is recommended that fluorescein dyes be used first to assure, visually, that good mixing of tracers is achievable. The application of radioactive tracers for flow measurements has proven successful elsewhere, at little expense. Tritium may not be suitable to use as a tracer for irrigation canals because it the convention of the conventions of may interfere with the groundwater regime. If tritium is widely injected into the system, the environment might become too contaminated, causi nental studies to be no longer reliable (Lantz-PTT) W89-02713

SURFACE WATER HYDROLOGY,

Vizgazdalkodasi Tudomanyos Kutato Intezet, Bu-

Vizgazdalkodasi Tudomanyos Kutato Intezet, Bu-dapest (Hungary).

A. Szollosi-Nagy, Z. W. Kundzewicz, and J. Cordova-Rodriguez.

IN: Hydrology 2000. International Association of Hydrological Sciences, Inst. of Hydrology, Wal-lingford, England. IAHS Publication No. 171, 1987. p 9-15.

Descriptors: *Research priorities, *Surface water, *Hydrologic studies, Rainfall-runoff relationships, Water pollution effects, Stochastic hydrology, Lakes, Hydrology, Data acquisition.

Apart from rainfall-runoff relationships, anthropo-genic impacts, and deficiencies of statistical and stochastic hydrology, there are several further spe-cific problems relevant to surface water hydrology discussed here, that may direct development of this subarea. For example, the assessment of volumes of water on the surface of the Earth and underground is neither accurate nor reliable. Assessment of global water balance has relied on relatively crude accounts of the oceanic phase of the hydrological cycle and, in particular, evaporation from oceans and precipitation over ocean surfaces. Even the net flow of water from land to ocean has not yet been precisely evaluated. Emergence of global hydrology offers challenging studies of 'teleconnections,' i.e, high correlations between values of hydrological variables observed in remote regions, with ac-count of transport time lags. There is a clear need count of transport time lags. There is a clear need to break down barriers between different subareas of hydrology and between hydrology and other sciences. Lake hydrology will probably turn further toward the application of hydrodynamic models, particularly in three-dimensional models that consider turbulence, analysis of water body/bottom sediment interaction and more generally the connections with water quality, including eutrophication problems. (See also W89-02717) (Lantz-PTT) W89-02719

EMERGING ISSUES IN SURFACE WATER

QUALITY RESEARCH, Geological Survey, Denver, CO. For primary bibliographic entry see Field 5G. W89-02721

KARST WATER TEMPERATURE AND THE SHAPING OF MALHAM COVE, YORKSHIRE, For primary bibliographic entry see Field 2F. W89-02737

FLOOD PROBLEM IN PERSPECTIVE.

Middlesex Polytechnic, London (England). Flood Hazard Research Centre. For primary bibliographic entry see Field 4A. W89-02744

ASSESSING THE HEALTH EFFECTS OF

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J. Emery.
IN: Flood Hazard Management: British and International Perspectives. Geo Books, Norwich, England. 1987. p 245-261, 1 tab, 27 ref.

Descriptors: *Public health, *Flooding, *Flood damage, Surveys, Cost-benefit analysis, Decision making, Warning systems, Flood protection, Flood plain management, Great Britain.

Disaster research has shown that floods affect the general health of a flooded community, and these effects may last for several years after the event. Not enough is known at present to determine accurately the extent and duration of flood related health problems for a flood prone community. Because of this lack of knowledge, such problems are not included in British assessments of rotential necause of this fack of knowledge, such problems are not included in British assessments of potential flood damage. research in this field is reveiwed, and suggestions are made of circumstances may reduce or aggravate flood related ill-health. Varireduce or aggravate flood related ill-health. Various research methods for determining health effects of floods are outlined. The development of the questionnaire used by the Flood Hazard Research Center is discussed, together with some early results from its use. It is hoped that by studying the effects of different flood events on different communities, a pattern of flood produced health problems will be established. A greater understanding of the health effects of floods may enable their incorporation into benefit cost calculations, thereby improving the decision-making process. (See also W89-02743) (Author's abstract)

FORMULAS FOR VELOCITY, SEDIMENT CONCENTRATION AND SUSPENDED SEDIMENT FLUX FOR STEADY UNI-DIRECTIONAL PRESSURE-DRIVEN FLOW,

National Oceanic and Atmospheric Administra-tion, Seattle, WA. Pacific Marine Environmental

For primary bibliographic entry see Field 2J. W89-02779

PEAK/RISK/CULVERT: A PROGRAM TO COMPUTE PEAK FLOWS, HYDROLOGIC RISK, AND CIRCULAR CULVERT SIZES AT FOREST ROAD CROSSINGS,

Bureau of Land Management, Roseburg, OR. M. Butler.

Available from the National Technical Information Service, Springfield, VA 22161, as PB88-204086. Price codes: A03 in paper copy, A01 in microfiche. BLM Technical Note 374, November 1986. 37p, 16 fig, 4 tab, 5 ref, append.

Descriptors: *Rainfall-runoff relationships, *Design flow, *Culverts, *Hydraulics, *Computer programs, *Flood peak, Flow velocity, Flow profiles, Flow measurement, Flood frequency, For-

BASIC computer program was developed to aid the hydrologist (and other specialists involved in water projects) in the calculation of design peak flows, evaluation of hydrologic risk, and selection of circular culverts. The program was written for the sizing of circular culverts at forest road crossings, but may be extended to other applications such as bridges, watershed management projects, and other uses where the calculation of design and other uses where the calculation of design events and hydrologic risk is needed. A discussion of each subject is included with instructions on how to use the program. Example problems to illustrate the program. The peak flow portion may be adapted to other locations where regional flood frequency equations have been developed. The

Streamflow and Runoff—Group 2E

computational methods are described briefly.

INTENSIVE SURVEY OF THE FOX RIVER BASIN FROM THE WISCONSIN STATE LINE TO OTTAWA, ILLINOIS: 1982.
Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control. For primary bibliographic entry see Field 5G. W89-02841

NATIONAL SURFACE WATER SURVEY: NA-TIONAL STREAM SURVEY PHASE I - PILOT

SURVEY, Utah Water Research Lab., Logan. For primary bibliographic entry see Field 5G. W89-02842

EXPERIMENTAL
GEOMORPHOLOGY
(DRAINAGE NETWORK, PIEDMONT AND
CHANNEL MORPHOLOGY),
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 2J.
W89-02847

CHEMICAL AND BIOLOGICAL SURVEY OF LAKES AND STREAMS LOCATED IN THE EMERALD LAKE WATERSHED, SEQUOIA NATIONAL PARK, California Univ., Santa Barbara. Marine Science

For primary bibliographic entry see Field 2H. W89-02852

INTENSIVE SURVEY OF THE KISHWAUKEE RIVER AND ITS TRIBUTARIES, 1983. Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control. For primary bibliographic entry see Field 5C. W89-02858

EFFECTS OF GAS-PIPELINE CONSTRUCTION ON THE AQUATIC ECOSYSTEM OF CANADA CREEK, PRESQUE ISLE COUNTY,

MICHIGAN,
Argonne National Lab., IL. Energy and Environmental Systems Div.
For primary bibliographic entry see Field 4C.
W89-02861

CATCHMENT EXPERIMENTS IN FLUVIAL GEOMORPHOLOGY.
Proceedings of a Meeting of the International Geographical Union Commission on Field Experiments in Geomorphology, Exeter and Huddersfield, UK, August 16-24, 1981. Geo Books, Norwich, England. 1984. 593p. Edited by T. P. Burt and D. E. Walling.

Descriptors: *Catchment areas, *Geomorphology, *Fluvial geomorphology, Channel morphology, Sediment transport, Stream erosion.

Sediment transport, Stream erosion.

Contributions based on papers presented at the August 1981 meeting of the International Geographical Union Commission on Field Experiments in Geomorphology, and on field experiments visited in England and Wales, are reviewed. The general theme of the meeting was 'Catchment Experiments in Fluvial Geomorphology' and specific topics featured include: (1) runoff processes and erosion dynamics, (2) sediment and solute yields, and (3) hillslope and channel processes. The meeting generated wide-ranging discussion on both the conceptual framework of field experiments and the techniques and operational details. A common thread running through the discussion held during the meeting was the need to enhance the scientific status of fluvial geomorphology through more rigorous application of scientific method in all its aspects - experimental design, measurement techniques, and data analysis. In particular, the need to establish models applicable to a wide range of locations, and to avoid the case study approach were strongly emphasized. (See W89-02881 thru W89-02913) (Miller-PTT)

CATCHMENT EXPERIMENTS IN FLUVIAL GEOMORPHOLOGY: A REVIEW OF OBJECTIVES AND METHODOLOGY,

W89_02880

TIVES AND METHODOLOGY, Exeter Univ. (England). Dept. of Geography. T. P. Burt, and D. E. Walling. IN: Catchment Experiments in Fluvial Geomor-phology. Geo Books, Norwich, England. 1984. p 3-18, 1 fig, 41 ref.

Descriptors: *Catchment areas, *Drainage, *Geo-morphology, *Fluvial geomorphology, Channel morphology, Sediment transport, Stream erosion.

morphology, "Fluvial geomorphology, Channel morphology, Sediment transport, Stream erosion. The role of catchment studies in fluvial geomorphology is discussed and it is concluded that the use of catchment experiments will continue. The drainage basin provides a clearly defined functional unit for the study of fluvial processes within which many subsystems exist at a variety of scales. The major effects of this functional approach include: (1) fluvial geomorphology, in adopting a systems approach, provides a broad overlap with many other environmental science disciplines, and (2) interaction between studies of contemporary catchment processes and interest in current system operation has determined that much fluvial geomorphology is now conducted without any strong regard for long-term landform development. Adoption of the deductive scientific method can be seen as both a cause and effect of recent changes in fluvial geomorphology. The adoption of statistical methods has led to a theoretical approach in which the formulation of an idealized view or model of reality precedes the establishment of independent field or laboratory experiments designed specifically to test that model. The major divisions of this volume reflect a trend towards integration of research within the drainage basin and the sections have been made deliberately broad, given the difficulty of providing narrower boundaries across which a number of papers would straddle uncomfortably. It is observed that fluvial geomorphology is now becoming established as a scientific discipline; even so, without continued strict attention to all aspects of scientific methodology, the development of models applicable to catchment landforms at a variety of temporal and spatial scales may prove capable of interaction. (See also W89-02880) (Miller-PTT)

CONTROLS ON OVERLAND FLOW GENERA-

TION,
Bristol Univ. (England). Dept. of Geography.
M. G. Anderson, D. Bosworth, and P. E. Kneale.
IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p
21-34, 7 fig, 2 tab, 15 ref.

Descriptors: *Topography, *Slopes, *Rainfall-runoff relationships, *Fluvial geomorphology, *Geomorphology, *Runoff, *Overland flow, *Model studies, Catchment areas, Erosion.

In the study of overland flow, there are two approaches that can be taken: (1) the application of theories that are applicable to specified boundary and hydraulic conditions of natural flow on hillsand hydraulic conditions of natural flow on hills-lopes, and (2) the identification by field investiga-tions of problems with calibrating models of over-land flow. The apparent dilemma is that while various theories can be shown to be suitable for specific conditions of overland flow, the hydraulic parameters vary so greatly that it is especially difficult in the case of overland flow to design relatively simple general models for inclusion in hydrological models. This study attempts to delimit those conditions under which it may prove possible to make empirical estimations of overland flow responses, and those conditions demanding a much greater detail of investigation for such predictions to be successful. It is demonstrated that such a to be successful. It is demonstrated that such a distinction cannot be made according to scale criterion alone. At the 'larger scale', topography is shown to be an important determinant regarding the feasibility of estimating overland flow using unit hydrograph techniques, while at the plot scale the detailed group of topographic variables is shown to be of overriding importance. (See also W89-02880) (Miller-PTT) PIPEFLOW AND PIPE EROSION IN THE MAESNANT EXPERIMENTAL CATCHMENT, University Coll. of Wales, Aberystwyth. Dept. of

J. A. A. Jones, and F. G. Crane. J. A. A. Jones, and F. G. Crane. IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 55-72, 5 fig, 4 tab, 14 ref.

W89-02882

Descriptors: *Wales, *Pipe erosion, *Fluvial geomorphology, *Soil erosion, *Piping, *Catchment areas, *Geomorphology, Experimental basins,

The hydrological role of natural piping in a humid upland catchment, using the Macsnant basin in mid-Wales as a study area, was investigated. The research involved three major areas of enquiry: (1) the spatial extent, (2) connectivity and relative importance of pipeflow to stream discharge, and (3) the factors responsible for generating pipeflow. In addition, the use of bedload traps has shown that pipeflow is a significant agent of erosion. The research demonstrates that pipes are a major source of runoff in this catchment. Great variation between pipes is revealed suggesting that categories of flow regime need to be expanded considerably beyond a simple division into ephemeral and perennial. (See also W89-02880) (Author's abstract) stract) W89-02884

FLOODPLAIN RESPONSE OF A SMALL TROPICAL STREAM,

Reading Univ. (England). Dept. of Soil Science. S. Nortcliff, and J. B. Thornes.

IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 73-85, 6 fig, 1 tab, 9 ref.

Descriptors: *Rainfall-runoff relationships, *Geomorphology, *Fluvial geomorphology, *Runoff, *Flood plains, *Tropical regions, Streams, Erosion, Brazil, Overland flow.

The runoff dynamics of a small tropical stream are shown to be dependent on activity on the flood-plain rather than to hillslope hydrology. Quickflow is almost entirely the result of saturation overland flow from floodplain areas immediately adjacent to the channel. Despite seasonal contrasts in precipitation, the floodplain retains sufficient moisture in the dry season for its runoff response to remain constant throughout the year. The floodplain is fed by two dominant mechanisms, lateral inflow from the channel and groundwater inflow (as opposed to subsurface stormflow) from beneath the interfluves. Inputs from overbank flow are important in the wet season. (See also W89-02880) (Author's abstract) The runoff dynamics of a small tropical stream are abstract)

PATTERN OF WASH EROSION AROUND AN UPLAND STREAM HEAD,

Geomorphological Services Ltd., Marlow (Eng-

For primary bibliographic entry see Field 2J.

RUNOFF AND SEDIMENT TRANSPORT DY-NAMICS IN CANADIAN BADLAND MICRO-CATCHMENTS,

Scarborough Coll., Westhill (Ontario). Dept. of Geography.

R. B. Bryan, and W. K. Hodges.

IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 115-131, 6 fig, 2 tab, 25 ref.

Descriptors: *Soil erosion, *Badlands, *Gully erosion, *Geomorphology, *Sediment transport, *Canada, *Rainfall-runoff relationship, Fluvial geomorphology, Catchment areas, Small watersheds, Rainstorms, Erosion, Runoff.

Group 2E-Streamflow and Runoff

The major components of runoff and sediment transport in badland micro-catchments are de-scribed. Rainsplash plays an important role in sedi-ment entrainment but is not significant in sediment ment entransment out is not significant in sediment transport. The dominant mode of sediment trans-port on all lithologies and surfaces is surface or sub-surface runoff. The timing, duration and volume of runoff discharge are critical and vary widely on different lithologic surfaces and with widely on different inhologic surfaces and with changes in antecedent moisture conditions. Despite exhibiting very complex patterns of water and sediment transport, the results provide a good basis for understanding the variable response of mesos-cale catchments to typical storm events. (See also W89-02880) (Author's abstract)

RUNOFF AND SEDIMENT PRODUCTION IN A SMALL PEAT-COVERED CATCHMENT: SOME PRELIMINARY RESULTS, Huddersfield Polytechnic (England). Dept. of Ge-

ography. T. P. Burt, and A. T. Gardiner.

IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 133-151, 7 fig, 5 tab, 15 ref.

Descriptors: *Rainfall-runoff relationships, *Catchment areas, *Geomorphology, *Runoff, *Erosion, *Fluvial geomorphology, *Peat, Overland flow, Soil water, Infiltration capacity, Sedimentation, England, Sediment vield.

Runoff and sediment production in a small peat-covered catchment on the blanket peat moorlands of the Southern Pennies, U.K. is discussed with reference to the contrasts between the heavilyreference to the contrasts between the neavity-eroded deep peat of the catchment interfluves and the shallower peat of the sloping Cotton Grass moorlands. Observations of overland flow, infiltra-tion capacity, and soil moisture status all suggest that surface runoff is dominant, this being conthat surface runoff is dominant, this being con-firmed by hydrograph analyses. Clear spatial dif-ferences exist in the contributing area of surface runoff in the two types of peat moorland which are reflected in the production of sediment at the two sites. Suspended sediment transport rates are con-sistently higher, and better related to stream dis-charge, at the heavily eroded peat subcatchment. (See also W89-02880) (Author's abstract) W89-02888

HYDROLOGY AND WATER QUALITY OF A DRAINED CLAY CATCHMENT, LOCKLE PARK, NORTHUMBERLAND, Ministry of Agriculture, Fisheries and Food, Cambridge (England). Field Drainage Experimental User

A. C. Armstrong.

IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p
133-168, 5 fig. 4 tab, 19 ref.

Descriptors: *Drainage effects, *Clays, *Catchment areas, *Water quality, Hydrology, Soil water, Fluvial geomorphology, England, Mole drainage, Geomorphology, Runoff, Erosion.

Closely spaced drains and mole drainage treatments are compared to the natural soil water regime on a sloping clay site. The dominant natural water movement on this site is down the slope, within the plough layer, and close spaced drains serve only to intercept this flow. Mole drainage, however, lowers the natural water table in the soil and reduces surface flow. The undrained areas discharge as much runoff by plough layer and surface layer flow as is removed by artificial drainage. There was no evidence that artificial drainage increased the nutrient losses from the site. In an arable situation, artificial drainage has only small effects on the hydrological output from the site as a whole, although it has profound effects on the soil water regime within the site. However, with a damaged grass sward, the almost complete eliminasoft water regime within the site. Flowever, with a damaged grass sward, the almost complete elimination of surface runoff by artificial drainage results in a marked reduction in the total runoff from drained areas. (See also W89-02880) (Author's abstract) W89-02889

SURFACE AND SUBSURFACE SOURCES OF SUSPENDED SOLIDS IN FORESTED DRAIN-AGE BASINS IN THE KEUPER REGION OF LUXEMBOURG,

Amsterdam Univ. (Netherlands). Lab. for Physical Geography and Soil Science. For primary bibliographic entry see Field 2J. W89-02892

SOURCES OF VARIATION OF SOIL ERODI-BILITY IN WOODED DRAINAGE BASINS IN LUXEMBOURG, Amsterdam Univ. (Netherlands). Lab. for Physical Geography and Soil Science. For primary bibliographic entry see Field 2J. W89-02893

MICROEROSION PROCESSES AND SEDI-MENT MOBILIZATION IN A ROADBANK GULLY CATCHMENT IN CENTRAL OKLA-

HOMA, Oxford Polytechnic (England). Dept. of Geography. For primary bibliographic entry see Field 2J. W89-02894

WATER AND SEDIMENT DYNAMICS OF THE HOMERKA CATCHMENT, Polish Academy of Sciences, Krakow. Inst. of Geography and Spatial Organization. For primary bibliographic entry see Field 2J. W89-02895

SOURCES OF SEDIMENT AND CHANNEL CHANGES IN SMALL CATCHMENTS OF RO-MANIA'S HILLY REGIONS, Institutul de Geografie, Bucharest (Romania). For primary bibliographic entry see Field 2J. W89.07866

DEVELOPMENT OF FIELD TECHNIQUES FOR ASSESSMENT OF RIVER EROSION AND DEPOSITION IN MID-WALES, UK,

Institute of Hydrology, Powys (Wales). For primary bibliographic entry see Field 2J. W89-02898

SOME IMPLICATIONS OF SMALL CATCH-MENT SOLUTE STUDIES FOR GEOMOR-PHOLOGICAL RESEARCH,

Coventry (Lanchester) Polytechnic (England).
Dept. of Geography.
I. D. L. Foster, and I. C. Grieve.
IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 359-378, 5 fig. 6 tab, 31 ref.

Descriptors: *Small watersheds, *Weathering, *Catchment areas, *Fluvial geomorphology, *Geomorphology, *Solutes, England, Soil water, Rivers, Denudation.

The role of small drainage basin studies in geomorphological research is highlighted with reference to a small catchment experiment in Midland England. Detailed chemical analysis relating to precipitation, through-fall, soil water and river water samples permits evaluation of predominant weathering processes, and calculation of rates of process ering processes, and calculation of rates of process operation. Comparison of such studies with other environments enables broad regional controls on denudation rates to be identified. (See also W89-0280) (Author's abstract)

HYDROCHEMICAL CHARACTERISTICS OF A DARTMOOR HILLSLOPE,

Plymouth Polytechnic (England). Dept. of Geo graphical Sciences.

grapnical Sciences.
A. G. Williams, J. L. Ternan, and M. Kent.
IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p
379-398, 8 fig. 4 tab, 26 ref.

Descriptors: *Slopes, *England, *Geochemistry, *Water chemistry, *Model studies, *Geomorpho-

logy, Catchment areas, Hydrologic models, Soil water, Rain, Overland flow, Runoff, Fluvial geomorphology.

A hydrological model for a thick regolith characteristically found on the hillslopes of the Dartmoor granite, where the slope regolith thicknesses in gramte, where the slope regolith incknesses mexcess of 20 m have been recorded in reservoir site investigations, is proposed. The model is based on research in the Narrator Brook Catchment, S.W. Dartmoor and considers the effects of four alternative interflow pathways on the stream water chemistry. When the solute composition of the waters ustry. When the solute composition of the waters was plotted on stability diagrams, a clear contrast between the four interflow pathways was evident. Weathering of silicate minerals on the slope crest was tending to gibbsite, while the other mathematicals. Weathering of silicate minerals on the slope crest was tending to gibbsite, while the other pathways tended to kaolinite. A deep interflow pathway was very similar in composition to the spring waters. These results indicate that weathering is probably rapid and controlled by rain/soil water interactions. (See also W89-02880) (Miller-PTT) W89-02903

MAGNITUDE AND FREQUENCY CHARAC-TERISTICS OF SUSPENDED SEDIMENT TRANSPORT IN DEVON RIVERS,

Exeter Univ. (England). Dept. of Geography For primary bibliographic entry see Field 2J. W89-02904

FLOW PROCESSES AND RIVER CHANNEL

MORPHOLOGY,
University of East Anglia, Norwich (England).
School of Environmental Sciences. For primary bibliographic entry see Field 2J. W89-02910

INFLUENCE OF VEGETATION ON STREAM CHANNEL PROCESSES,

Southampton Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2J.

STREAM RESPONSE TO FLASH FLOODS IN UPLAND SCOTLAND.

Saint Andrews Univ. (Scotland). Dept. of Geogra-

phy. A. Werritty.

IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 537-560, 11 fig, 3 tab, 22 ref.

Descriptors: *Stream erosion, *Channel morphology, *Geomorphology, *Scotland, *Flash floods, Rivers, Channeling, Flow, Fluvial geomorphology, Streams.

Three years' observations on a short reach of Dorback Burn, Cairngorm, Scotland demonstrate great complexity in the pattern of channel adjustments to flow regime in gravel-bed rivers. This paper examines the scale and pattern of channel adjustment, the geomorphologic significance of flash floods in such rivers, and the pattern of recovery following a flash flood. The sequence of competent flows and the state of the channel prior to a given flood event are shown to be important controls of channel adjustment. (See also W89-02880) (Author's abstract) Three years' observations on a short reach of Dor-W89-02912

EXPERIMENTAL METHOD IN GEOMOR-

PHOLOGY, British Columbia Univ., Vancouver. Dept. of Geography. M. Church.

IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 563-580, 1 fig, 29 ref.

Descriptors: *Geomorphology, *Channel morphology, *Channel erosion, Catchment areas, Catchment basins, Hydrology, Statistical analysis, Fluvial geomorphology.

Streamflow and Runoff-Group 2E

1987. 42p, 5 fig, 3 tab, 13 ref, 1 plate in pocket.

Descriptors: *Flood peak, *Illinois, *Probability distribution, *Statistical analysis, Gaging stations, Flood forecasting, Flood recurrence interval, Mathematical analysis.

Four techniques for estimating generalized skew in Illinois were evaluated: (1) a generalized skew map of the US; (2) an isoline map; (3) a prediction equation; and (4) a regional-mean skew. Peak-flow records at 730 gaging stations having 10 or more annual peaks were selected for computing station skews. Station skew values ranged from -3.55 to 2.95, with a mean of -0.11. Frequency curves computed for 30 gaging stations in Illinois using the variations of the regional-mean skew technique are similar to frequency curves computed using a skew variations of the regional-mean skew technique are similar to frequency curves computed using a skew map developed by the US Water Resources Council (WRC). Estimates of the 50, 100,, and 500-yr floods computed for 29 of these gaging stations using the regional-mean skew techniques are within the 50% confidence limits of frequency curves computed using the WRC skew map. Although the three variations of the regional-mean skew technique were slightly more accurate than the WRC map, there is no appreciable difference between flood estimates computed using the variations of the regional-mean technique and flood estimates computed using the WRC skew map. (Peters-PTT)

USE OF LINEAR COMPARTMENTAL SIMULATION APPROACH FOR QUANTITATIVE INTERPRETATION OF ISOTOPE DATA UNDER TIME VARIANT FLOW CONDITIONS, International Atomic Energy Agency, Vienna (Austria). Div. of Research and Labs. For primary bibliographic entry see Field 7C. W89-03017

FLOODS IN CENTRAL TEXAS, AUGUST 1-4.

E. E. Schroeder, B. C. Massey, and E. H. Chin. Available from Books and Open-File Reports Sec-tion, USGS, Box 25425, Denver, CO 80225. USGS Professional Paper 1332, 1987. 39p, 27 fig, 15 tab, 18 ref.

Descriptors: *Floods, *Texas, Rainfall, Storms, Rivers, Flood peak, Streamflow, Flood damage, Tropical Storm Amelia.

Catastrophic floods caused by record rainfall occurred in central Texas during August 1-4, 1978. Torrential rain initiated by the remnants of tropical Torrential rain initiated by the remnants of tropical storm Amelia fell over south-central Texas during August 1-3, and very intense rain due to the interaction between the cold front and maritime air mass fell over north-central Texas on August 3-4. Rainfall of more than 48 inches near Medina in south-central Texas established a new United States record of extreme point rainfall for a 72-hour period. Major flooding occurred on the Medina and Guadalupe Rivers. Severe to minor flooding occurred on the Brazos, Llano, Pederales, and Nueces Rivers. Floods with recurrence intervals in excess of 100 years and recordsetting peak discharges were observed at several streamflow stations. Thirty three lives were lost and total damages reportedly exceeded \$110 million. (Author's abstract) thor's abstract) W89-03025

HYDROLOGY, GEOMORPHOLOGY, AND DAM-BREAK MODELING OF THE JULY 15, 1982, LAWN LAKE DAM AND CASCADE LAKE DAM FAILURES, LARIMER COUNTY, COLO-

Geological Survey, Lakewood, CO. For primary bibliographic entry see Field 8A. W89-03027

RUNOFF CHARACTERISTICS AND WA-SHOFF LOADS FROM RAINFALL-SIMULA-TION EXPERIMENTS ON A STREET SUR-FACE AND A NATIVE PASTURE IN THE

Criteria for a scientific experiment are shown and examples of work on river channel behavior and sediment mobilization are used to illustrate the nature of experimental enquiry in geomorphology. Statistical methods are used in order to demonstrate the covariability of observations, to account for incidental variability introduced by extraneous conditions, and to judge whether or not the data support the hypotheses. Proper statistical design must be considered for this. In the classification of geomorphological experiments of Slaymaker et al., types I (direct manipulation of landscape) and III (stratified observations) qualify as genuine experiments. Scale change is an important tool to extend the range of type I experiments. Geomorphological enquiry begins with the development of concepts from prior work. A hybrid type I/III type experiment turns out to be most feasible. Special attention is given to catchment experiments, of which there is a long tradition in the cognate science of hydrology, since they appear especially suitable for many geomorphological enquiries. (See also W89-02880) (Miller-PTT)

OHIO STREAM REGIONALIZATION PROJECT: A COMPENDIUM OF RESULTS, Northrop Services, Inc., Corvallis, OR. For primary bibliographic entry see Field 2H. W89-02932

QUANTITY AND QUALITY OF STORM RUNOFF FROM THREE URBAN CATCH-MENTS IN BELLEVUE, WASHINGTON, Geological Survey, Tacoma, WA. Water Re-sources Div. For primary bibliographic entry see Field 5B. W89-03000

ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS FOR WISCONSIN URBAN STREAMS, Geological Survey, Madison, WI. Water Resources Div. D. H. Conger. Available from Books and Open File Report Section, USGS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4005, December 1986. 18p, 3 fig, 8 tab, 8 ref.

Descriptors: *Flood frequency, *Rainfall-runoff relationships, *Wisconsin, *Urban hydrology, *Regression analysis, *Flood peak, Drainage areas, Imprevious areas, Catchment areas, Flood dis-

Equations for estimating magnitude and frequency of floods for Wisconsin streams with drainage basins containing various amounts of existing or projected urban development were developed by flood-frequency and multiple-regression analyses. Multiple-gression techniques were used to devel-Multiple-regression techniques were used to devel-op equations for estimating flood frequencies at ungaged urban sites. The flood-frequency equa-tions are based on data from 32 urban gaging stations, including 19 crest-stage gages and 13 rain-fall-runoff gaging stations. Significant characteris-tics in the control of the control o tall-runoff gaging stations. Significant characteristics in the equations are drainage area and impervious area. Standard errors of estimate for the regression equations ranged from 32%-39%. Separate equations were developed for Milwaukee County. The USGS Distributed Routing Rainfall-Runoff Model-Version II was used to extend records by synthesis for the 13 rainfall-runoff urban stations. (Author's abstract) W89-03003

NATURAL FLOW AND WATER CONSUMPTION IN THE MILK RIVER BASIN, MONTANA AND ALBERTA, CANADA, Geological Survey, Reston, VA. Water Resources

Div. R. E. Thompson.

Available from Books and Open File Report Section, USGS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4006, (1986). 40p, 11 fig., 12 tab, 19 ref.

Descriptors: *Streamflow, *Water use, *Milk River, *Montana, *Alberta, Irrigation require-

ments, Municipal water, Domestic water, Governmental interrelations, Surface-groundwater relations, Evaporation, Agriculture.

A study was conducted to determine the differences between natural and nonnatural Milk River streamflow, to delineate and quantify the types and effects of water consumption on streamflow, and for refine the current computation procedure into one which computes and apportions natural flow. Water consumption consists principally of irrigated agriculture, municipal use, and evapotranspiration. Mean daily water consumption by irrigation ranged from 10 cu ft/sec to 26 cu ft/sec in the Canada part and from 6 cu ft/sec to 41 cu ft/sec in the US part. Two Canadian municipalities consume about 320 acre-ft and one US municipality consumes about 20 acre-ft and one US municipality consumes about 20 acre-ft yearly. Evaporation from the water surface comprises 80% 0 90% of the flow reduction in the Milk River attributed to total evapotranspiration. The current water-budget approach for computing natural flow of the Milk River where it reenters the US was refined into an interim procedure which includes allowances for man-induced consumption and a method for apportioning computed natural flow between the US and Canada. The refined procedure is considered interim because further study of flow routing, tributary inflow, and man-induced consumption is needed before a more accurate procedure for computing natural flow can be developed. (Author's abstract) W89-03004

REGIONALIZATION OF WINTER LOW-FLOW CHARACTERISTICS OF TENNESSEE STREAMS, Geological Survey, Nashville, TN. Water Re-sources Div.

sources Div.

R. H. Bingham.

Available from Books and Open File Report Section, USGS, Box 25425, Denver, CO 80225. USGS

Water-Resources Investigations Report 86-4007, 1986. 88p, 33 fig, 15 ref, 4 append, 2 plates in

Descriptors: *Tennessee, *Streamflow, *Low flow, *Seasonal variation, *Regional analysis, Re-gression analysis, Streamflow depletion, Transmis-sivity, Surface-groundwater relations, Drainsag-area, Catchment areas, Geology, Surface runoff.

Procedures were developed for estimating winter (December-April) low flows at ungaged stream sites in Tennessee based on surface geology and drainage area size. One set of equations applies to West Tennessee streams, and another set applies to Middle and East Tennessee streams. The equations do not apply to streams where flow is significantly altered by the activities of man. Standard errors of estimate of equations for West Tennessee are 22% - 35% and for middle and East Tennessee 31% - 36%. Statistical analyses indicate that summer low-flow characteristics are the same as annual low-flow characteristics are the same as annual low-36%. Statistical analyses indicate that summer low-flow characteristics are the same as annual low-flow characteristics, and that winter low flows are larger than annual low flows. Streamflow-reces-sion indexes, in days per log cycle of decrease in discharge, were used to account for effects of geology on low flow of streams. The indexes in Tennessee range from 32 days/log cycle for clay and shale to 350 days/log cycle for gravel and sand, indicating different aquifer characteristics of the geologic units that contribute to streamflows. the geologic units that contribute to streamflows during periods of no surface runoff. Streamflowourning periods of no surface runoit. Streamflow-recession rate depends primarily on transmissivity and storage characteristics of the aquifers, and the average distance from stream channels to basin divides. Geology at 'drainage basin size are the most significant variables affecting low flow in Tennessee streams according to regression analy-ses. (Author's abstract) W89-03005

ESTIMATING GENERALIZED SKEW OF THE LOG-PEARSON TYPE III DISTRIBUTION FOR ANNUAL PEAK FLOODS IN ILLINOIS, Geological Survey, Urbana, IL. Water Resources

DIV.
K. A. Oberg, and D. M. Mades.
Available from Books and Open File Report Section, USGS, Box 25425, Denver, CO 80225. USGS
Water-Resources Investigations Report 86-4008,

Group 2E-Streamflow and Runoff

DENVER METROPOLITAN AREA, COLORA-

DENVER STATES OF THE STATES OF

Descriptors: *Storm runoff, *Urban hydrology, *Simulated rainfall, *Urban runoff, *Pastures, *Colorado, Statistical analysis, Flushing, Rainfali intensity, Experimental design, Water quality.

Rainfall simulation studies were conducted in conjunction with the Denver Regional Urban Runoff Program to: (1) Compare runoff quantity and qual-Program to: (1) Compare runoff quantity and quality from two different intensities of rainfall on impervious plots having identical antecedent conditions, (2) document a first flush of constituent loads in runoff from 1,000-square-foot street-surface plots, (3) compare runoff characteristics from a street surface subjected to simulated rainfall with those from a 69-acre urban basin of mixed land use subjected to natural rainfall, (4) perform statistical analysis of constituent loads in the runoff with several independent variables, and (5) compare the quantity and quality of runoff from 400-square-foot plots of native grasses used for pasture and subjective forms. quantity and quality of runoff from 400-square-noot plots of native grasses used for pasture and subjected to simulated rainfall with that from a 405-acre basin covered with native grasses used for pasture and subjected to natural rainfall. A first flush of constituent loads occurred for most constituents in the runoff from most rainfall simulations on the street surface; however, a first flush did not occur street surface; nowever, a first thish and not occur in the runoff from simulated rainfall on the pasture. Intensity of rainfall and total rainfall are important variables determining constituent loads. The design of the experiment was such that intensity of rainfall of the experiment was such rata intensity of raintail and total rainfall were highly correlated, this pre-cluding the development of useful regression equa-tions to predict washoff loads. The quality of runoff from the simulated rainfall on the pasture was influenced by the disturbed perimeters of the plots, however, the runoff-to-rainfall ratios of the simulated storms fell within the range of ratios measured for natural storms over the adjacent 405-acre basin. (Author's abstract) W89-03036

DIVERSITY OF THE PARASITE ASSEMBLAGE OF FUNDULUS ZEBRINUS IN THE PLATTE RIVER OF NEBRASKA, Nebraska Univ.-Lincoln. School of Biological Sci-

For primary bibliographic entry see Field 2H. W89-03062

HYPORHEIC HABITAT OF RIVER ECOSYS-

TEMS, Montana Univ., Polson. Flathead Lake Biological

Nature NATUAS, Vol. 335, No. 1, p 64-66, September 1988. 2 fig, 2 tab, 18 ref.

Descriptors: *Invertebrates, *Rivers, *Hyporheic zone, *Ecology, Gravel-bed rivers, Riverine animals, Biotic productivity, Montana, Surfacegroundwater relations.

Contemporary river ecology is based primarily on biogeochemical studies of the river channel and one to the control of by riverine animals, is characterized as being spa-tially limited to no more than a few meters, in most cases centimeters, away from the river channel. However, riverine invertebrates were collected in hundreds per sample within a grid of shallow (10 m) wells located on the floodplain up to 2 km from the channel of the Flathead River, Montana. Preliminary mass transport calculations indicated that nutrients discharged from the hyporheic zone may be crucial to biotic productivity in the river chan-nel. The strength and spatial magnitude of these interactions demonstrate an unexplored dimension in the ecology of gravel-bed rivers. (Author's ab-

W89-03122

HYDROLOGIC DESIGN METHODOLOGIES FOR PREFEASIBILITY STUDIES OF SMALL-SCALE HYDRO AT UNGAUGED SITES, Acres International Ltd., Niagara Falls, NY. For primary bibliographic entry see Field 7A. W89-03129

MODELING OF TOTAL NITROGEN IN RIVER USING THE QUANTITY-QUALITY MODEL CEQUEAU (MODELISATION DE L'AZOTE TOTAL EN RIVIERE A L'AIDE DU MODELE QUANTITE-QUALITE CEQUEAU), Institut National de la Recherche Scientifique, Sainte-Foy (Quebec). For primary bibliographic entry see Field 5B. W89-03130

MATHEMATICAL HYDRAULIC MODEL OF

THE RIVER NENE - A CANALIZED, AND HEAVILY CONTROLLED RIVER. Mary Coll., London (England). Dept. of

Queen Mary Coll., London (Engana). Civil Engineering.
For primary bibliographic entry see Field 4A. W89-03141

PREDICTING THE EFFECTS OF A PESTICIDE RELEASE TO THE RHINE RIVER, Iowa Univ., Iowa City. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5C.
W89-03159

INFLUENCE OF A RIVER PLUME ON THE SEA-ICE MEIOFAUNA IN SOUTH-EASTERN HUDSON BAY, Arctic Biological Station, Ste. Anne de Bellevue

(Quebec). For primary bibliographic entry see Field 2L. W89-03189

MODIFICATION AND ASSESSMENT OF AN INDEX OF BIOTIC INTEGRITY TO QUANTIFY STREAM QUALITY IN SOUTHERN ON-

Toronto Univ. (Ontario). Dept. of Zoology. For primary bibliographic entry see Field 4C. W89-03211

HYDROLOGIC AND RIPARIAN INFLUENCES ON THE IMPORT AND STORAGE OF COARSE PARTICULATE ORGANIC MATTER IN A PRAIRIE STREAM, Kansas State Univ., Manhattan. Div. of Biology. For primary bibliographic entry see Field 2H. W89-03214

CORRESPONDENCE BETWEEN ECORE-GIONS AND SPATIAL PATTERNS IN STREAM ECOSYSTEMS IN OREGON, Northrop Services, Inc., Corvallis, OR. For primary bibliographic entry see Field 2H. W89-03223

BIOGENIC GASES AND THE OXIDATION AND REDUCTION OF CARBON IN AMAZON RIVER AND FLOODPLAIN WATERS,

Washington Univ., Seattle. School of Oceanography.

J. E. Richey, A. H. Devol, S. C. Wofsy, R. Victoria, and M. N. G. Riberio.

Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 1, p 551-561, July 1988. 6 fig, 3 tab, 42 ref. NSF Grants DEB 81-07522, BSR 83-16359 and NASA Grants NAGW-71, NAG1-55

Descriptors: *Amazon River, *Oxidation-reduction potential, *Organic carbon, *Flood plains, Fluctuations, Rivers.

The oxidation and reduction of organic carbon in mainstem, tributary, and floodplain waters of the Amazon River system were examined by analyzing

the distributions of free dissolved CO2, O2, CH4 and N2O. Concentrations of CO2 ranged from 150 microM in the Amazon mainstem to 200-300 microM in aerobic environments and up to 1,000 microM in aerobic environments and up to 1,0000 microM in oxygen-depleted environments of the floodplain. Apparent oxygen use ranged from 80 to 250 microM. Methane was highly supersaturated with respect to atmospheric equilibrium. Concentrations ranged from 0.06 microM in the mainstem 100 microM on the floodplain. Concentrations of N2O were slightly supersaturated in the mainstem (about 13 nanoM) but were undersaturated on the floodplain (averaging 9 nanoM). Fluxes calculated from these concentrations indicated decomposition of about 1600 g C/m-yr of organic carbon in Amazon floodplain waters. Analysis of relationships between CH4, O2, and CO2 concentrations indicated that about 50% of carbon mineralization on the floodplain is anaerobic, with 20% lost to the atmosphere as CH4. The predominance of anaerobic metabolism leads to consumption of N2O on the floodplain. Elevated concentrations of CH4 in the mainstem probably reflect input from the microM in oxygen-depleted environments of the the mainstem probably reflect input from the floodplain, while high levels of CO2 in the mainstem are derived from a combination of floodplain drainage and in situ respiration. (Author's abstract) W89-03247

MEASURING WATER CLARITY WITH A BLACK DISK.

Ministry of Works and Development, Hamilton (New Zealand). Water Quality Centre. For primary bibliographic entry see Field 7B. W89-03251

KINETIC CONTROL OF DISSOLVED PHOS-PHATE IN NATURAL RIVERS AND ESTU-ARIES: A PRIMER ON THE PHOSPHATE BUFFER MECHANISM,

Lamont-Doherty Geological Observatory, Pali-For primary bibliographic entry see Field 2K. W89-03253

FRESHWATER AND MARINE COUPLING IN ESTUARIES OF THE MISSISSIPPI RIVER DELTAIC PLAIN,

Louisiana State Univ., Baton Rouge, Center for Wetland Resources.
C. J. Madden, J. W. Day, and J. M. Randall. C. J. Madden, J. W. Day, and J. M. Randan. Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 982-1004, July 1988. 13 fig, 2 tab, 94 ref. NOAA Grant NA 85AA-D-5G141.

Descriptors: *Limnology, *Estuaries, *Mississippi River, *Deltas, Saline-freshwater interfaces, Sea-sonal variation, Lakes, Rivers.

The coupling of freshwater and marine environ-ments in coastal Louisiana, the nature of physical changes that occur in estuarine systems, the biologchanges that occur in estuarine systems, the biological responses to these changes, and the ways that biology determines the physical structure of the environment are described. The estuaries of Louisiana's Mississippi River deltaic plain exhibit sharp physical and biological contrasts due to their different successional stages in delta development. The Atchafalaya-Fourleague Bay complex is a young deltaic system with high freshwater and sediment inputs. The area has been undergoing rapid land building since 1973. The Barataria Basin estuary occupies a deltaic land mass which formed over 2000 B.P. and has since been isolated from riverine inflow and sediment renewal. It is expeririverine inflow and sediment renewal. It is experi-encing a high rate of land loss. A comparison of these estuaries offers an excellent opportunity to observe coupling of freshwater and marine environments at the extremes of their scale of interac-tion. In the Atchafalaya system, riverine input is highly seasonal, and the estuary receives most of its sediment input and high loadings of nutrients during spring. However, high turbidity and colder temperatures limit phytoplankton during this time. During the period of low flow in summer and fall, Gulf of Mexico waters dominate Fourleague Bay and provide an important interlude of clearer water when riverborne and regenerated nutrients can be maximally exploited by phytoplankton. The Barataria Basin estuary does not exhibit the strong

Groundwater-Group 2F

seasonality found in Fourleague Bay. Barataria re-ceives no direct riverine input, and the main hy-drologic inputs are precipitation and upland runoff. The Barataria estuary depends on organic produc-tion and resuspended lake bottom sediments for much of the marsh building that occurs. Therefore, in the Barataria system, tides, gulf water levels and in the Baratana system, tudes, guit water levels and wind-driven resuspension are much more important to maintenance of the wetland. The upper basin is heavily impacted by nutrient runoff from urban and agricultural areas and is eutrophic. Lower Barataria Basin remains in a more natural state. Despite being at opposite ends of the delta life cycle, both estuaries are highly productive and perform similar functions as important nursery grounds for juvenile marine and estuarine fishes. (Author's abstract) W89-03271

FERTILITY AND DISTURBANCE GRADI-ENTS: A SUMMARY MODEL FOR RIVERINE MARSH VEGETATION, Ottawa Univ. (Ontario). Dept. of Biology. For primary bibliographic entry see Field 2H. W89-03294

HYDROCHORY AND REGENERATION IN A BALD CYPRESS-WATER TUPELO SWAMP

FORES1, Savannah River Ecology Lab., Aiken, SC. For primary bibliographic entry see Field 2H. W89-03295

RESULTS OF A SHORT-TERM TOXICITY STUDY FOR THREE ORGANIC CHEMICALS FOUND IN NIAGARA RIVER DRINKING WATER,

Environmental Health Directorate, Ottawa (Ontar-io). Environmental and Occupational Toxicology Div.

For primary bibliographic entry see Field 5C. W89-03310

FLOOD INUNDATION MODELLING USING

FLOOD INUNDATION MODELLING USING MILHY,
Bristol Univ. (England).
M. G. Anderson, and L. Singleton.
Available from the National Technical Information
Service, Springfield, VA 22161, as AD-A192 729.
Price codes: A03 in paper copy, A01 in microfiche.
First Interim Report, December 1987. 28p, 10 fig.
10 tob. 3-67.

Descriptors: *Flooding, *Model studies, *Flood routing, Channels, Flood protection, Banks, Hy-

The objectives for the work reported here are: (i) the inclusion and evaluation of alternative geometric definitions for channel segment inter-flow; (ii) the evaluation of the legitimacy of routing channel segments separately downstream, to better model in and out of bank flows; (iii) the establishment of a working Fulda data set for evaluation of out-of-bank conveyance schemes; and (iv) the installation of SUN Work Station and transfer of HYMO to a UNIX operating system. Work undertaken in the six month period to December 1987: out of bank flood convergence; redefinition of channel geometry to incorporate in and out of bank flow; application to hydrograph generation; separate routing of tion to hydrograph generation; separate routing of channel and flood plain water; and establishment of the Fulda data set. (Lantz-PTT) W89-03330

2F. Groundwater

PROCEEDINGS OF THE FOCUS CONFER-ENCE ON SOUTHWESTERN GROUND WATER ISSUES. Albuquerque, New Mexico. March 23-25, 1988. National Water Well Association, Dublin, OH.

1988, 602 p.

Descriptors: *Symposium, *Conferences, *Geohydrology, *Water pollution effects, *Groundwater monitoring, *Groundwater management, Regional

development, Regional analysis, Soil water, Hydrocarbons, Organic compounds, Aquifers, Groundwater, Hydrology.

The FOCUS Conference on Southwestern Ground Water Issues was held in Albuquerque, New Mexico, March 23-25, 1988. Presented by the Association of Ground Water Scientists and Engineers with the support of more than 20 co-sponneers with the support of more than 20 co-sponsors, the conference focused on major topics in hydrogeology. Sessions were devoted to: southwestern groundwater management, regional hydrogeology, investigative techniques in groundwater, vadose zone investigations, impacts of underground storage tanks, dealing with petroleum hydrocarbons and other organic chemicals in groundwater, impacts of agricultural activities and impacts of mining activities on groundwater. Geoscientists, engineers and other intersted profession. impacts of mining activities on groundwater. Geos-cientists, engineers and other interested profession-als from the public and private sectors attended the meeting to expand their knowledge of southwest-ern groundwater issues. (See also W89-02363) (Au-thor's abstract) W89_02331

USE OF A REGIONAL GROUND-WATER FLOW MODEL FOR WATER RIGHTS ADMINISTRATION IN A SOUTHWEST ALLUVIAL

New Mexico State Engineer Office, Santa Fe. For primary bibliographic entry see Field 4B. W89-02332

TRANSITION FROM GROUND-WATER MINING TO INDUCED RECHARGE IN GEN-ERALIZED HYDROGEOLOGIC SYSTEMS, Leggette, Brashears and Graham, Inc., Albuquer-que, NM.
For primary bibliographic entry see Field 4B.
W89-02337

QUANTITY AND QUALITY OF RECHARGE TO THE OGALLALA AQUIFER FROM URBAN

RUNOFF, Brandes (R.J.) Co., Austin, TX. For primary bibliographic entry see Field 4C. W89-02340

IMPACT OF THE NEWPORT-INGLEWOOD STRUCTURAL ZONE ON HYDROGEOLOGIC

STRUCTURAL ZONE ON HYDROGEOLOGIC MITIGATION EFFORTS: LOS ANGELES BASIN, CALIFORNIA, Engineering Enterprises, Inc., Long Beach, CA. S. M. Testa, E. C. Henry, and D. Hayes. IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 181-203, 10 fig, 10 ref.

Descriptors: *Water pollution treatment, *Water pollution control, *Los Angeles basin, *Geohydrology, *Groundwater monitoring, *Water quality, Water chemistry, Planning, Aquifers, Hydrology.

The Newport-Inglewood structural zone has a major multi-faceted impact on groundwater occurrence, regime, quality and usage in the South Coast area The Los Angeles Basin, of California. Delineation and designation of the numerous water-bearing zones, and overall understanding of the geologic and hydrogeologic conditions encountered in the vicinity of this structural zone is essential to implementing anufer remediation and exhaust iered in the vicinity of this structural zone is essential to implementing aquifer remediation and rehabilitation strategies. A synopsis of the regional geologic and hydrogeologic setting with respect to stratigraphy, structure and groundwater occurrence, chemistry, quality and usage, is presented. The level of mitigation warranted in relation to the area's hydrogeologic past, present and future groundwater use is discussed. (See also W89-0234) (Author's abstract)

STATEWIDE GROUNDWATER QUALITY MONITORING NETWORK DESIGN, Arizona Dept. of Environmental Quality, Phoenix. For primary bibliographic entry see Field 5A.

RANDOM SURVEY OF VOC'S, PESTICIDES AND INORGANICS IN ARIZONA'S DRINK-ING WATER WELLS,

Arizona Dept. of Environmental Quality, Phoenix. For primary bibliographic entry see Field 5A. W89-02344

MEASUREMENT OF GROUNDWATER VE-LOCITY WITH A COLORIMETRIC BORE-HOLE DILUTION INSTRUMENT.

Weston (Roy F.), Inc., West Chester, PA. For primary bibliographic entry see Field 7B. W89-02345

IMPROVED FRESH WATER ASSESSMENT IN SAND AQUIFERS UTILIZING GEOPHYSICAL WELL LOGS,

WELL LUGS, ReSTech Houston, Inc., TX. R. P. Alger, and C. W. Harrison. IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 281-310, 13 fig, 4 tab, 20 ref, 3 append.

Descriptors: *Aquifer testing, *Borehole geophysics, *Resistivity, *Water quality, *Well logs, *Geophysics, Groundwater monitoring, Regional analysis, Water resources development, Geohydrology, Hydrology, Aquifers, Groundwater, Analytical methods, Hardness, Conductivity.

Evaluation of wells drilled for fresh water presents special problems in log analysis. In such analyses the problem is not to distinguish between two types of fluid, as in the evaluation of oil prospects, types of fluid, as in the evaluation of oil prospects, but to determine the quality and quantity of water that may be obtained from various strata. It has previously been shown that apparent formation factor in freshwater sands is sensitive to three factors: porosity, water resistivity, and effective grain size. Therefore, values of porosity and true resistivity are inadequate to predict formation water resistivity. An alternative solution utilizes true resistivity, flushed zone resistivity, and mud filtrate resistivity to determine formation water resistivity. In addition, permeability may be determined from porosity, formation water resistivity, and true resistivity, utilization of water resistivity and SP derived activity provides an improved determination of total dissolved solids and also yields a water hardness index. Applications include yields a water hardness index. Applications include the determination of formation water quality, permeability (transitivity), yield, and volume (storati-vity). This methodology is easily quantified and can be used on an area wide basis for regional resource assessment. (See also W89-02331) (Author's abstract) W89-02347

FIELD SIMULATION OF WASTE IMPOUND-MENT SEEPAGE IN THE VADOSE ZONE, New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.
For primary bibliographic entry see Field 5B.
W89-02348

FIELD STUDY OF EPHEMERAL STREAM-

AQUIFER INTERACTION,
New Mexico Inst. of Mining and Technology,
Socorro. Dept. of Geoscience.
W. B. Cox, and D. B. Stephens.

W. B. Coa, and D. B. Stephens.

IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 337-358, 11 fig, 7 ref.

Descriptors: *Ephemeral streams, *Surface-groundwater relations, *New Mexico, *Rio Puerco, *Rio Salada, *Infiltration, *Groundwater recharge, Groundwater monitoring, Monitoring wells, Aquifers, Model studies, Hydrology, Geohydrology, Seasonal variation, Alluvial channels.

Ephemeral streams, the Rio Puerco and Rio Salado, north of Socorro, NM, near Interstate-25 were instrumented to investigate infiltration and groundwater recharge due to channel seepage. Monitor wells, neutron access holes and stream

Group 2F-Groundwater

stage recorders provided information to characterize the nature of stream aquifer interaction and to quantify recharge. The Rio Puerco has a relatively well-defined channel with a small width to depth ratio. The Rio Puerco flows in response to both winter and summer precipitation, as well as spring runoff. The stream carries a large suspended sediment load which results in the development of a clogging layer on the channel bottom. The Rio Salado has a large width-depth ratio and a braided channel filled mostly with permeable sand and Salado has a large width-depth ratio and a braided channel filled mostly with permeable sand and gravel. The Rio Salado flows mostly in the summer in response to thunderstorms. The results show that hydraulic connection to the underlying aquifer is highly variable on the Rio Puerco. For the Rio Salado, hydraulic connection during streamflow is highly dependent on depth to groundwater and localized channel characteristics. THe results are relevant to conceptual models of stream-aquifer interaction, calculated channel and canal losses, and numerical modeling of flow and solute transport in groundwater systems. (See also solute transport in groundwater systems. (See also W89-02331) (Author's abstract)

EPHEMERAL RUNOFF AND GROUNDWAT-ER RECHARGE,

New Mexico Univ., Albuquerque. Dept. of Civil

R. J. Heggen.
IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 359-

Descriptors: *Ephemeral streams, *Surface-groundwater relations, *Runoff, *Rainfall-runoff relationships, *Groundwater recharge, *Infiltra-tion, Groundwater monitoring, Groundwater management, Groundwater movement, Hydrology, Geohydrology, Perched aquifers, Alluvial chan-

Surface infiltration rates were measured in the Albuquerque, New Mexico region. More than 100 Albuquerque, New Mexico region. More than 100 split ring tests were carried out over a variety of soil, cover type and density, and land use conditions. The primary objective of the study was the estimation of direct runoff from storm events. Complementary to that objective was the determination of the fate of infiltrated water. Ephemeral channel beds, generally uniform sand with interspersed lenses of clay, have infiltration rates an order of magnitude above those of the surrounding terrain. Channel losses are not as much limited by terrain. Channel losses are not as much limited by the surface infiltration rate as they are by the flow the surface infiltration rate as they are by the flow duration before bed sealing and the capacity of the subsurface voids. Initial observations indicate that whereas ephemeral runoff tends to be rapidly ab-stracted, only in special cases does this water progress to the groundwater. More commonly, water is retained near the surface by (1) a perched aquiclude lens, and/or (2) the adsorptive forces of the channel media. Subsequently the majority of the water is lost to evaporation. Of significance to water management is that while transmission losses water management is that while transmission losses from ephemeral channels may be of primary sig-nificance to issues of surface hydrology, the signifi-cance may be less in aquifer analysis. (See also W89-02331) (Author's abstract)

RECOVERY OF MOISTURE/SOLUTE PROFILES IN RECLAIMED COAL-MINE SPOIL, NORTHWEST NEW MEXICO, New Mexico Bureau of Mines and Mineral Re-

sources, Socorro.

In: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 523-545, 16 fig, 1 tab, 10 ref.

Descriptors: *Groundwater level, *Water level recovery, *Mining effects, *Land reclamation. *Coal mining, *Mine wastes, *Groundwater recharge, *Iaotope studies, Chemical analysis, Aquifers, Chlorides, Tracers,

In a recent study of recharge at the Navajo Mine, the unsaturated zone beneath 32 sites (7 undis-

turbed and 25 reclaimed) was sampled for chloride mass-balance analysis. Resulting plots of soil-water chloride vs depth for reclaimed areas are of three general types: (1) large variation in chloride content, suggesting equilibrium not yet regained, (2) uniformly low chloride, in some cases above a deep peak (flushing bulge), and (3) shallow chloride peak above lower values at depth, as seen in undisturbed settings. Flushing bulges beneath depressions may reflect input from ponding rather than nonequilibrium. Five sites were resampled for stable-isotope and tritium and analyses. In a depression reclaimed 6 yrs previously, oxygen-18 and deuterium profiles differed markedly, indicating nonequilibrium. Stable-isotope plots for another 6 yr old site and all 10-yr old sites, generally support equilibrium. In all cases, tritium results are anomayr old site and all 10-yr old sites, generally support equilibrium. In all cases, tritium results are anomalous, apparently because of vapor-phase water movement under these arid conditions. In spite of low precipitation (6 inches/yr) and recharge (< 0.5 inch/yr), unsaturated profiles are apparently reo.3 inch yi, australiate profiles are apparently established between 6 and 10 yrs after revegeta-tion. The addition of irrigation water during reve-getation and run-on enhances the process. (See also W89-02331) (Author's abstract)

HYDROGEOLOGICAL MAPPING IN ASIA AND THE PACIFIC REGION.

For primary bibliographic entry see Field 7B. W89-02364

ASSESSMENT AND MAPPING OF AUSTRA-LIA'S GROUNDWATER RESOURCES, Bureau of Mineral Resources, Geology and Geo-physics, Canberra (Australia). G. Jacobson.

In: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p 17-28, 7 fig, 1 tab, 8 ref.

Descriptors: *Australia, *Hydrogeology, *Mapping, *Hydrologic maps, *Groundwater, *Groundwater availability, *Geohydrology, Groundwatermanagement, Groundwater recharge, Aquifers.

Groundwater is a vital resource for Australia's future development but its use is constrained by various factors including salinity. Australia's groundwater resources have not been fully investigated and a national hydrogeological mapping pro-gram has been initiated and is expected to become a basis for groundwater assessment, development, a basis for groundwater assessment, development, and management. In the hydrogeological maps so far published, groundwater salinity has been the main parameter mapped, and in this respect Australian maps are different from those of other countries. Problems which need to be addressed in the Australian hydrogeological mapping program include the determination of appropriate map scales and the cartographic representation of groundwatand the cartographic representation of groundwater salinity, superimposed aquifers, and variations in recharge. Automated cartography may aid the immense task of the hydrogeological mapping of Australia. (See also W89-02364) (Author's abstract) W89-02364)

HYDROGEOLOGICAL MAPPING IN FIJI, Department of Mineral Resources, Suva (Fiji). A. T. Simpson.

H. 1. Simpson. In: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p 29-37, 3 fig, 2 tab, 4 ref.

Descriptors: *Fiji, *Hydrogeology, *Mapping, *Hydrologic maps, *Groundwater, Developing

Hydrogeological mapping in Fiji is essentially in its infancy. An attempt to produce a tentative hydro-geological map of the largest island, Viti Levu, was started in September 1983 with the help of the Regional Mineral Resources Development Centre Hydrogeological Consultant. The exercise has pro-vided a good case study on the production rhydrogeological consultant. The exercise has pro-vided a good case study on the production in a short time of a hydrogeological map using limited data. Though the map produced is far short of the printing stage, it has provided the first step in an exercise which would be of enormous benefit to the country. (See also W89-02364) (Author's ab-stract)

W89-02366

POSITION PAPER: SOLOMON ISLANDS.

Ministry of Lands, Energy and Natural Resources, Honiara (Solomon Islands).

IN: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p 39-48, 3 fig, 8 ref.

Descriptors: *Solomon Islands, *Water resources development, *Hydrogeology, *Mapping, *Hydrologic maps, Water demand, Islands.

Water resource assessment in the Solomon Islands water resource assessment in the Solomon islands has been confined to meeting the immediate needs of small scale demand. Progress in water resources assessment and development has been limited by a shortage of professional expertise; in 1983 this shortcoming was alleviated by the secondment from New Zealand of a Water Resources Officer. from New Zealand of a Water Resources Officer. Approximately 66% of the Solomon Islands have now been geologically surveyed at the 1:50,000 scale, and 1:50,000 topographic maps are available for the whole country. The Solomon Islands Geo-logical Survey is interested in the methods other Economic and Social Commission for Asia and the Pacific countries employ to acquire and present their hydrogeological information and is particu-larly interested in assessing the usefulness of hy-drogeological maps in an island(s) context. (See also W89-02364) (Author's abstract) W89-02364) (Author's abstract) W89-02367

HYDROGEOLOGICAL DEVELOPMENT IN VANUATU.

VANOATU, Department of Geology, Mines, and Rural Water Supplies, Vila (Vanuatu). R. J. Marks.

1N: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p 51-57, 1 fig, 4 ref.

Descriptors: *Vanuatu, *Hydrogeology, *Mapping, *Hydrologic maps, *Groundwater availableity, *Geohydrology, *Surface water, Surfacegroundwater relations, Groundwater, Irrigation, Groundwater potential, Groundwater irrigation, Groundwater management.

gained its independence in 1980. At vanuatu gameu is independence in 1980. At present, the country relies heavily on aid. One of the greater priorities in development is the construction of rural water supplies. These village water-supply schemes rely heavily on surface water sources. However, groundwater is becoming water sources, rowever, groundwater is decoming increasingly important as new government establishments are built, and agriculture, industry, and tourism expand. Most of the more advantageous areas for development are situated on the coastal areas for development are situated on the coastan platform, which is often formed of reef limestone. Such areas typically lack surface water, while groundwater is often plentiful and easily accessible. The islands have been mapped geologically, and this, together with other related data, would form this, together with other related data, would form the basis for a hydrogeological mapping program. The work is necessary to aid the development and protection of groundwater resources in this current phase of development. Unfortunately, due to re-stricted funds this work is unlikely to commence unless it is supported by financial aid. (See also W89-02364) (Author's abstract)

WATER-BEARING ZONES IN THE MINING AREA OF THE NORTHERN REGION OF BAN-GLADESH WITH REGARD TO UTILIZATION OF MINE WATER FOR IRRIGATION AND OTHER USES,

Bangladesh Mineral Exploration and Development Corp. Dacca. M. Siddique Ali.

N. Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p 61-75, 2 fig, 5 tab, 19 ref.

Descriptors: *Bangladesh, *Mine drainage, *Water quality, *Hydrogeology, *Irrigation, *Groundwater availability, *Surface water, Groundwater, Sur-

Groundwater-Group 2F

face-groundwater relations, Groundwater manage-

Two basic economic resources of a developing nation such as Bangladesh are mining and agriculture. Rapid economic development can be achieved if mineral resources are explored and utilized properly and if arable lands are put under widespread and intensive cultivation by providing irrigation facilities in the dry seasons. In the mining sector, the per capita consumption of minerals and mineral products in Bangladesh is one of the lowest in the world. There are few opportunities of finding minerals on the surface. Outer a few minerals finding minerals on the surface. Quite a few minerals of economic value have so far been found in the country, some of which are covered by highly permeable sandstones, sands, and gravels. Thus, the high water content in the overburden makes the sinking of mine shafts extremely difficult and the sinking of mine shalts extremely difficult and expensive. As far as agriculture is concerned, the economy of Bangladesh is mainly agro-based. Agriculture contributes more than 55% to the total Gross Domestic Product (GDP). The contribution of the northern region in this sector to the total GDP is nearly 20% in terms of current prices. But due to the serious lack of surface water in lean due to the serious lack of surface water in lean seasons, a process of desertification has set in here. Fortunately, the favorable geological and hydrogeological conditions promise unlimited availability of fresh groundwater in this region. This groundwater, together with mine water as a byroduct, can be used in a profitable and planned way in agriculture and for domestic and industrial supply. (See also W89-02364) (Author's abstract) W89-02369

DEVELOPMENT AND ACHIEVEMENTS OF HYDROGEOLOGICAL MAPPING IN CHINA, Ministry of Geology and Minerals, Beijing (China). Advisory Committee on Geology Science and Technology. M. Chen, and S. Jiao.

No. Chen, and S. Jiao.

IN: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p 79-90.

Descriptors: *China, *Hydrogeology, *Mapping, *Hydrologic maps, *Groundwater availability, *Geohydrology, *Surface water, Groundwater, Hydrography

The regional hydrogeological map, is one of the basic data sources for planning the national economy, industrial and agricultural construction, and for scientific research. This brief outline of regional hydrogeology in China reviews the process of development in compiling hydrogeological maps with various aims and scales (including map series or atlases) on the basis of the hydrogeological mapping which has been carried out and explains the important role of these maps in the national economy. The principles and methods of compilation of hydrogeological maps and the major experiences as well as present problems are discussed. After hydrogeological maps and the major experiences as well as present problems are discussed. After hydrogeological maps of provinces, autonomous regions, cities or basins, can be compiled on the basis of the regional hydrogeological maps in accordance with given requirements. Practical experience in China has resulted in the choice of the scale of geological maps. The natural conditions prevailing in countries in the region of Asia and the Pacific, especially in Asia, have many common features, and the existing hydrogeological myological are are similar or the same. But, exchange of scientific knowledge in the field of hydrogeological mapping has been very limited in the past; therefore, it is necessary to strengthen contacts so that experience and information can be exchanged. (See also W89-02364) (Davis-PTT) W89-02370

GROUNDWATER IN CHINA,

Zhengding Inst. of Hydrogeology and Engineering Geology (China).

IN: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p 91-120, 1 fig, 1 ref.

Descriptors: *China, *Hydrography, *Hydrogeology, *Mapping, *Hydrologic maps, *Groundwater, *Groundwater availability, *Geohydrology, *Surface-groundwater relations, Soil types, Aquifers, Groundwater relation, Groundwater mining, Groundwater movement, Groundwater relation, Groundwater relation, Groundwater movement, Groundwater relations, Groundwater movement, Groundwater relations.

On account of the integrated effects of physiogra-phical and geological factors, the distribution and occurrence of groundwater in China is divided into seven regions; the groundwater is classified occurrence of groundwater in China is divided into seven regions; the groundwater is classified into four basic types: porewater in unconsolidated deposits, Karst fissure-cavity water exposed and semi-exposed karst fissure-cavity water exposed and semi-exposed karst fissure-cavity water in permafrost. Groundwater is abundant in the great plains in the east, but the change of water quality is complicated. The Loess plateau and the bedrock mountainous areas are comparatively short of water. However, in recent years good results have been achieved through exploration in the sections with copious deep groundwaters. In Karst areas, cavity fissure water is abundant, but it is unevenly distributed. In local areas the land is arid, and there is a serious shortage of water. Very good results have been obtained from the work that has been done in search of underground river systems. It is also promising to conduct hydrogeological prospecting and study have been made. As a result, the preliminary regional distribution of China's groundwater has been outlined. With further development of national economy, groundwater in such a vast territory should be studied and utilized more intensely, contributing to China's modernization. (See also W89-02364) (Davis-PTT)

ASSESSMENT OF HYDROGEOLOGICAL FEA-

ASSESSMENT OF HIDROGEOIDICAL FEATURES USING THE TECHNIQUE OF TER-RAIN CLASSIFICATION, Hong Kong Public Works Dept. Geotechnical Control Office. For primary bibliographic entry see Field 7B. W89-02372

GROUNDWATER RESOURCES DEVELOP-MENT AND MANAGEMENT IN INDIA, Central Ground Water Board, New Delhi (India).

In: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p 145-150.

Descriptors: *India, *Hydrography, *Hydrogeology, *Mapping, *Hydrologic maps, *Groundwater, *Groundwater availability, *Geohydrology, *Surface water, Surface-groundwater relations, Irrigation, Wastewater renovation, Groundwater potential, Groundwater integation, Groundwater management, Groundwater mining, Groundwater recharge, Hydrologic budget.

Growing recognition of the role of groundwater in Growing recognition of the role of groundwater in providing an assured water supply for irrigation, domestic, and industrial requirements has led to its accelerated development in India during the last two decades. At present, 43% of irrigation water requirements are met from groundwater. Dependence on this resource has recently increased due to the introduction of high-yielding crop varieties and the adentition of multi-creative necessary. the introduction of high-yielding crop varieties and the adoption of multi-cropping patterns; both require a timely and reliable irrigation water supply. Increased water supply is needed for industrial growth and for meeting the requirements of several hundred urban centers and of the rural population of india. Groundwater-resource utilization in canal-command areas offers a means of stabilizing the water table as well as of correcting the imbalance in the groundwater system which causes water-logging problems. Water balance studies in unconsolidated formations, consolidated rocks, and semi-consolidated formations are described. The full development of the resources may pose a semi-consolidated formations are described. The full development of the resources may pose a number of management problems. Studies on all possible aspects including artificial recharge, opti-mum water use, recycling of waste water, and prevention of groundwater pollution are already

being undertaken to equip the scientists, engineers, and planners with a high level of knowledge and proficiency so that they can manage the situations likely to arise in the future. (See also W89-02364) (Davis-PTT)

HYDROGEOLOGICAL PROBLEMS OF HARD ROCK AREAS OF SOUTHERN INDIA, Deutsche Gesellschaft fuer Windenergie e.V., Hamburg (Germany, F.R.). K. C. B. Raju.

IN: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p 151-156.

Descriptors: *Rocks, *Hydrogeology, *Hydrography, *Mapping, *Hydrologic maps, *India, *Groundwater, *Groundwater availability, Irrigation, Groundwater irrigation, Groundwater management, Groundwater mining, Groundwater movement, Water table fluctuations, Groundwater recharge, Anisotropy

Wide variation in climatic conditions, physiographic features, and in rock types of southern India produces a complicated hydrogeological setting and makes its assessment problematic. Most of the lineaments and major fractures can be grouped into three directions: (1) NE-SW or Easter Ghat trend; three directions: (1) NE-SW or Easter Ghat trend; (2) NW-SE or Dharwarian trend; (3) E-W. Some of the major river courses follow the major lineaments along parts of their courses. As regards groundwater productivity, the NW-SE trending lineaments and fractures supply the highest yields; E-W trending, moderate yields; and NE-SW trending, the lowest yields. From the hydrogeological point of view, it is important that the hydrogeological map distinguishes to some detail between the different rock types and between different grades of metamorphism. The groundwater outputs are higher in areas of tension fractures. The strike-frequency diagrams of joints/fractures in the case of rocks exclusively with vertical or near-vertical fracture systems gives a three-dimensional perspecof rocks exclusively with vertical or near-vertical fracture systems gives a three-dimensional perspec-tive of fracture systems, directions of maximum intersection, and degree of anisotropy; likewise for stereographic projections in rocks with fractures varying in magnitude of dip. Groundwater devel-opments in hard rocks is generally confined to the opments in hard rocks is generally continued to the weathered mantle. However, the increase in withdrawal has resulted in the decline of the water table. This has necessitated exploring deeper fracture aquifers by means of drilled wells. The hydrogeological map and other special maps preserved for the Noyil-Amaravati-Ponnani river basin are described. In view of the relevance of statistical analysis of joints and fractures in hard rocks, it is stressed that future hydrogeological maps should include such analyses. (See also W89-02364) W89-02374

STATUS OF HYDROGEOLOGICAL MAPPING IN INDONESIA IN 1983, For primary bibliographic entry see Field 7B. W89-02375

REVIEW OF GROUNDWATER IN THE RE-PUBLIC OF KOREA, Korean Inst. of Energy and Resources, Seoul (Re-public of Korea). Applied Geology Div. W. Lee.

D. W. Lee. In: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p 165-174, 1 fig. 1 tab, 4

Descriptors: *Igneous rocks, *Metamorphic rocks, *Hydrography, *Korea, *Groundwater, *Groundwater availability, Groundwater management, Surface-groundwater relations, Irrigation, Groundwater relations, Irrigation, Groundwater, Figure 1988, 1988, 1989, water irrigation.

Almost 70% of the Korean peninsula is covered with Precambrian metamorphic rocks and various Mesozoic igneous rocks. The average total annual rainfall is estimated at 114 billion cu m (114 x 109 cu m). Of this total, 15.3 billion cu m are utilized,

Group 2F-Groundwater

and of this amount 60% or more is used for agricultural irrigation. The increase in population tocultural irrigation. The increase in population to-gether with rapid industrialization, great urban growth, and an improvement in the standard of living in Korea will continue to produce higher water consumption and increased demands; there-fore, there is an urgent need to develop ground-water resources. Accordingly, the Korea Institute of Energy and Resources has been carrying out of Energy and Resources has been carrying out water resources development projects on a nation-al scale since 1967, mainly focusing on the study of hydrogeological aspects of the four river basin areas. (See also W89-02364) (Author's abstract) W89-02376

STATUS OF HYDROGEOLOGICAL MAPPING IN PENINSULAR MALAYSIA, Geological Survey of Malaysia, Ipoh. Hydrogeology Div. N. K. Ang.

N. H. Ang. In: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p. 175-182, 2 fig, 3 ref.

Descriptors: "Hydrogeology, "Mapping, "Hydrologic maps, "Groundwater, "Malaysia, "Groundwater availability, Surface-groundwater relations, Irrigation, Groundwater potential, Groundwater irrigation, Groundwater management.

In recent years there has been an upsurge of hy-drogeological activities in Malaysia, due to the greater need to exploit groundwater as a source of greater need to exploit groundwater as a source of water supply. As a step toward the systematic assessment of the groundwater potential of the country and to facilitate the planning and implementation of various hydrogeological programs, a hydrogeological map of the peninsula was published. The problems and limitations involved in the preparation of the map are discussed. In view the preparation of the map are discussed. In view of the importance of such maps, a new approach is being adopted to recent hydrogeological programs giving due emphasis to the mapping aspect. (See also W89-02364) (Author's abstract)

NOTES ON THE HYDROGEOLOGICAL MAP OF SARAWAK,

Geological Survey of Malaysia, Kuching, Hydrogeology Section. Y. Mailvaganam.

In: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p. 183-190, 1 fig, 16 ref.

Descriptors: *Rocks, *Hydrogeology, *Mapping, *Hydrologic maps, *Sarawak, *Groundwater, *Groundwater availability, *Geohydrology, *Surface water, Surface-groundwater relations, face water, Surface-groundwater relations, Groundwater potential, Groundwater irrigation,

The Hydrogeological Map of Sarawak has been prepared using the guidelines set out in the 'General Legend for the International Hydrogeological at Legend for the International Hydrogeological Map of Europe, Hannover, 1974. Some changes have been introduced into the 'General Legend' to take into account the varying local conditions and needs. The knowledge of groundwater resources in Sarawak is sparse. This situation is mainly due to the abundance of surface water resulting from the the abundance of surface water resulting from the heavy precipitations which amounts to more than 3000 mm/year. Consequently, the demand for groundwater and the need for groundwater research have been very low. This situation is changing and interests in this aspect of water resources are gaining momentum, especially in the coastal areas of Sarawak where the surface supplies are unable to cope with the demand for fresh water during the drier months of the year. The map was compiled by Y. Mailvaganam and S.P. Chen. In preparation of the map, the authors relied greatly on geological data and the little hydrogeological data that are available. The following three hydrodata that are available. The following three hydrodata that are available. The following three hydrodata that are available. data that are available. The following three hydro-geological classes are recognized: (I) Groundwater in porous (commonly unconsolidated) rocks; (II) Groundwater in jointed rocks, including karstic rocks; (III) Only local occurrence of groundwater (in porous or fissured rocks) or area with insignifi-cant groundwater resources. In the map, information is also given on the individual characteristics

of groundwater in accordance with the 'General Legend', on surface water, on artificial works for the utilization of groundwater and surface water, and on some geological data. (See also W89-02364) (Author's abstract)

WATER RESOURCES AND HYDROGEOLOGI-CAL MAPPING IN THE MONGOLIAN PEO-PLE'S REPUBLIC, Ministry of Water Economy, Ulan Bator (Mongo-

L. Tumur. IN: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p 191-194.

Descriptors: *Mineral springs, *Hydrogeology, *Mapping, *Hydrologic maps, *Mongolia, *Groundwater, *Groundwater availability, *Geo-"Groundwater, Croundwater availability, Geo-hydrology, "Surface water, Surface-groundwater relations, Irrigation, Groundwater potential, Groundwater irrigation, Groundwater manage-ment, Groundwater mining, Groundwater recharge.

There are over 400 mineral and thermal springs in Mongolia, divided into the following main types:

(I) Acidic carbon-dioxide cold mineral water, (II) Hydrogen-sulfide and nitrogen thermal water (up to +100oC), and (III) Sodium-chloride mineral to + 100oC), and (III) Sodium-chloride mineral water with a high dissolved solids content. Groundwater studies were initiated in the 1940s. The first hydrogeological map of Mongolia was published in 1971 at a scale of 1:1,500,000 on the basis of the geological map of Mongolia. A hydrogeological map has been set up on the principle of regional and zonal groundwater at a scale of 1:500,000. Large-scale maps for technical projects and city planning are being compiled. The data shows that the total volume of usable groundwater resources of Mongolia amounts to 6000 million cu m/a. Groundwater occurring in river flood-plains m/a. Groundwater occurring in river flood-plains has a close hydraulic connection with the river and can be referred to as either a ground or surface water resource. Groundwater which is not drained by a river network can be used without limitation. It is not hydraulically connected with streams, so it is independent of surface water resources. Groundis independent of surface water resources. Ground-water this features a more of less uniform yield throughout the year and is a reliable source of water supply. This is particularly important for the south of the country, where no surface runoff is available. Groundwater is mainly recharged through precipitation and infiltration during the summer-autumn period. (See also W89-02364) (Davis-PTT) W89-02379

HYDROGEOLOGY OF THE BUTWAL-BHAIR-AHWA AREA, LUMBINI ZONE, NEPAL, Department of Mines and Geology, Kathmandu

Okepal).

G. S. Thapa, and Y. L. Vaidya.

IN: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p. 195-208, 1 fig, 3 tab, 3 ref.

Descriptors: *Tinau River, *Alluvial sediments, *Aquifers, *Nepal, *Hydrogeology, *Groundwater availability, *Groundwater recharge, *Groundwater storage, Groundwater movement, Groundwater, Surface-groundwater relations, Soil types,

The Butwal-Bhairahwa area is a part of the Lumbini Terai located within the Rupandehi District in the western Terai, Nepal, at an altitude of about 100 m. The hydrogeological picture of the region has been built up from surface observations and from the investigation of more than 150 boreholes. These show a succession of alluvial sediments of interes snow a succession or aniuvais estiments of different grain size from gravel and sand to silt and clay. The proportion of coarser sediments to finer-grained sediments in the section decreases, in gen-eral, from north to south. In the north, on both sides of the Tinau River, there extends a zone built up mainly of coarse-grained sediments known as the Bhabar zone. Beyond its periphery and also beneath the coarse-grained Bhabar sediments there is a gradual transition towards finer-grained mate-

rials. The sediments of generally finer-grained tex-ture are termed Gangetic sediments. There are both phreatic and confined aquifers in the area. Phreatic aquifers are found in the Bhabar zone and in the near-surface layers of the Gangetic sedi-ments. Confined aquifers exist along the periphery and south of the Bhabar zone. Most of the groundwater recharge takes place in the Bhabar zone by infiltration of rainfall and surface flow in streams. influration of ramial and surface now in streams. The change in groundwater storage in the Bhabar zone over the monsoon period as estimated from the rise in water level measures about 130 million cu m. Groundwater flow in the confined aquifers under the existing hydraulic gradient is tentatively estimated to be about 60 million cu m/a. Recharge of the phreatic aquifers of the Gangetic sediments through infiltration from rainfall and from water ponded on the paddy fields is not yet known. (See also W89-02364) (Author's abstract)

PAKISTAN-STATUS REPORT, Pakistan Water and Power Development Authority. Lahore. For primary bibliographic entry see Field 4B. W89-02381

HYDROGEOLOGICAL MAPPING IN THE PHILIPPINES.

Bureau of Mines and Geo-Sciences, Manila (Philip-

In: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p 215-220, 1 fig.

Descriptors: *Geology, *Alluvial fans, *Sediments, *Rocks, *Hydrogeology, *Philippines, *Mapping, *Groundwater, *Groundwater availability, Surface-groundwater relations, Irrigation, Aquifers, Groundwater potential, Groundwater irrigation, Groundwater management, Groundwater mining, Groundwater movement, Water table fluctuations, Groundwater recharge.

As of December, 1983, 70% of the Philippines have been covered by reconnaissance hydrogeological surveys. Map scales are usually 1:250,000, but recently hydrogeological maps have been produced at a scale of 1:50,000. The rest of the country is covered by 'Regional Water Resources Development Study' reports which are based mainly on the evaluation of existing geological and hydrological data. The BMG also conducts detailed groundwater studies with the objective of assessing the available water resources in any specific area and the location of best possible sites for groundwater exploration and development. Quaternary geology is used in locating sites underlain by more permeable sediments such as abandoned river channels and alluvial fans. Other surface and groundwater resources studies searching for water groundwater resources studies searching for water for irrigation, domestic, and industrial purposes by government agencies and corporations are de-scribed. In the groundwater availability currently being prepared there are three major groups of geological formations based on the mode of occurgeorogana rormations based on the mode of occur-rence and movement of groundwater: (1) rocks in which flow is intergranular, (II) rocks in which flow is through fractures and solution openings, and (III) rocks with local or no groundwater. (See also W89-02364) (Davis-PTT) W89_02382

DEVELOPMENT OF GROUNDWATER RE-SOURCES IN SRI LANKA, National Water Supply and Drainage Board, Co-lomb (Sri Lanka)

lombo (Sri Lanka) For primary bibliographic entry see Field 4B. W89-02383

STATUS OF HYDROGEOLOGICAL MAPPING IN THAILAND, Land Development Dept., Bangkok (Thailand). Seil Surgan Direction

Soil Survey Div. . Wongsawat.

IN: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover,

Groundwater-Group 2F

West Germany. 1985. p 231-246, 2 fig, 15 ref.

Descriptors: *Water resources development, *Mapping, *Thailand, *Hydrogeology, *Maps, Geophysics, Stratigraphy, Geomorphology.

The first hydrogeological map of Thailand, scale 1:500,000, was published in 1975, covering an area of 200,000 km2 in the northwestern part of the country. The map was prepared from analyses of existing data obtained from hydrogeological investigations, since 1955 and applications and properties. existing data obtained from hydrogeological inves-tigations since 1955 and geological, geophysical, and hydrological surveys; lithology, stratigraphy, structural geology, geomorphology, drilling logs, pumping tests, and monitoring of water levels and water quality, etc., have been taken into account. pumping tests, and monitoring of water levels and water quality, etc., have been taken into account. Various attempts have been made at hydrogeological mapping in other parts of the country since 1965. The hydrogeological maps, scale 1:500,000, of the northern, central, eastern, western, and southern regions were published in mid-1983. The hydrogeological maps covering the whole country of Thailand at a scale of 1:500,000 in 4 separate sheets are available for distribution. The single-sheet hydrogeological maps, scales 1:1,000,000 and 1:2,500,000, have already been drafted and are beeing printed. The hydrogeological map at the scale of 1:500,000 was chosen at the national standard scale for planning of water resources development in the regions. The legend and symbols used here were based on UNESCO recommendations and the hydrogeological map of England and Wales, scale 1:625,000, published in 1977. Detailed hydrogeological maps at scales of 1:100,000 for each provincial area are planned. (See also W89-02364) (Author's abstract) W89-02384 W89-02384

HYDROGEOLOGICAL MAPPING IN THE SO-CIALIST REPUBLIC OF VIETNAM, For primary bibliographic entry see Field 4B. W89-02385

INTERNATIONAL LEGEND FOR HYDRO-GEOLOGICAL MAPS: PRINCIPLES AND AP-

PLICATION, Bundesanstalt fuer Geowissenschaften und Roh-stoffe, Hanover (Germany, F.R.). For primary bibliographic entry see Field 7B. W89-02386

DATA REQUIREMENTS FOR HYDROGEOLO-

GICAL MAPS, Bundesanstalt fuer Geowissenschaften und Roh-For primary bibliographic entry see Field 7A. W89-02387

ORGANIZATION OF HYDROGEOLOGICAL MAPPING PROGRAMS,

Geological Survey of Western Australia, Perth. Dept. of Mines. For primary bibliographic entry see Field 7B. W89-02388

REPORT ON HYDROGEOLOGICAL MAPS OF KARSTIC TERRAINS,

International Association of Hydrogeologists, Paris

International Conference (France).

H. Paloc, and J. Margat.
IN: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p. 301-315, 1 fig.

Descriptors: *Mapping, *Karst hydrology, *Hydrogeology, *Maps, *Limestone, Hydrologic data, Groundwater, Water resources development.

Cartographic documents in the field of karstic Cartographic documents in the field of karstic hydrogeology should facilitate, as should hydrogeological mapping in general, communication and transmission of knowledge between specialists, but should also provide those who are non-specialists in the field of underground waters with the information which the latter need for their particular work. Thus it is desirable that the recent effort displayed cartography for essentially scientific pur-poses should be continued and extended to the

territories not yet covered by this type of map. It is also Using some published maps and explanatory notes as examples, the various standards and forms of representation which can be adopted for limestone rocks are discussed. Specific hydrogeological features and types of information concerning hydrogeologic mapping in karstic terrain are described, with emphasis on European examples. (See also W89-02364) (Davis-PTT) W89-02389

HYDROGEOLOGICAL MAPPING IN COAST-AL AREAS.

Rijks Geologische Dienst, Haarlem (Netherlands).

Nils Geologische Delsa, namen S. Jelgersma, and E. Romijn. IN: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p 317-324, 5 ref.

Descriptors: *Hydrogeology, *Maps, *Standards, *Coastal zones, *Groundwater, *Groundwater relations, Groundwater recharge, Hydroclimatology, Groundwater recharge, Hydroclimatology, Groundwater potential, Groundwater manage-

ment.

The main purpose of the revised draft of the International Legend for Hydrogeological Maps is to facilitate the preparation of hydrogeological maps, regardless of scale, in standardized form. For rural water supply small scale maps with the aim of representing quality and quantity of groundwater as it occurred in a region gives excellent general information; hydrogeological maps are needed to a larger scale for the water supply of big cities with industrial, domestic, and irrigation uses of water. These maps should lay stress on the amount and quality of available groundwater, location of recharge areas and give hydroclimatological data such as precipitation, runoff, infiltration, and evaporation. It is not advisable to put all the data in one map. The thickness, lithology, and physical and chemical characteristics of surface layers situated on top of the aquifer should be presented in a supplementary map. This map can be of great importance with regard to problems of groundwater pollution. This article proposes a refining of the International Legend for use on large scale maps in coastal areas where there is an important demand for water supply firrigation areas and large cities. International Legend for use on large scale maps in coastal areas where there is an important demand for watery supply (irrigation areas and large cities with industries) and where several aquifers are present. The importance of collecting hydrological and hydrogeological data and their storage in a data bank is stressed. The construction of a hydrogeological map out of the data bank is only and application of the various purposes of the data bank. The special problem of the quality of the groundwater and the occurrence of salt and brackish water of aquifers in coastal areas is discussed. The disastrous man-induced geological hazards in coastal areas of land subsidence due to groundwater withdrawal is discussed. (See also W89-02364) (Davis-PTT) (Davis-PTT) W89-02390

SUMMARY OF WELL CONSTRUCTION, TESTING, AND PRELIMINARY FINDINGS FROM THE ALLIGATOR ALLEY TEST WELL, BROWARD COUNTY, FLORIDA,

Geological Survey, Tallahassee, FL. Water Resources Div. For primary bibliographic entry see Field 4B. W89-02465

GROUNDWATER LEVELS IN WYOMING, 1978 THROUGH SEPTEMBER 1987.

Geological Survey, Cheyenne, WY. Water Resources Div. For primary bibliographic entry see Field 4B. W89-02468

SEEPAGE STUDY OF A 15.3 MILE SECTION OF THE CENTRAL UTAH CANAL, PAHVANT VALLEY, MILLARD COUNTY, UTAH, Geological Survey, Salt Lake City, UT

For primary bibliographic entry see Field 2E. W89-02469

WATER RESOURCES OF WALWORTH COUNTY, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources

J. Kume, and I. Howells

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 85-4015, 1987. 70p, 33 fig, 7 tab, 46 ref.

Descriptors: *Groundwater, *Aquifers, *Ground-water storage, *Aquifer characteristics, *Hydro-logic data, *Water resources data, *South Dakota, Streamflow, Data collections, Walworth County.

The water resources of Walworth County, South Dakota are for the most part undeveloped. In 1978, only about 10,000 acre-feet of water was used for irrigation, stock, domestic, and public supplies; most of this water came form Lake Oahe on the most of this water came form Lake Qahe on the Missouri River, and was used for irrigation. The lake stores about 22 million acre-feet of water; the average annual flow of the Missouri River is about 16 million acre-feet. Tributary streams normally are dry at least 10 months per year. Average annual net surface runoff from the county is 7,900 acre-feet. At least 99 percent of the precipitation per year; is lest by exportensivistic. An estimate per year is lost by evapotranspiration. An estimat-ed 1.2 million acre-feet of water is stored in eight ed 1.2 million acre-feet of water is stored in eight aquifers in the glacial drift. The water generally is suitable for irrigation, stock, and domestic use. It is estimated that more than 55 million acre-feet of water is stored in nine aquifers in the bedrock. These aquifers are in the Dakota Formation, Inyan Kara Group, Sundance and Minnelusa Formations, Madison Group, Devonian strata, and Stony Mountain, Red River, and Deadwood Formations. The water is slightly to very saline and, at best, is suitable for livestock and marginally acceptable for domestic surplies. (USGS) domestic supplies. (USGS) W89-02489

GROUNDWATER RESOURCES OF RUSK COUNTY, TEXAS,

Geological Survey, Austin, TX. Water Resources

W. M. Sandeen

Available from OFSS, USGS, Box 25425, Denver, CO 80225. Texas Water Development, Austin, Board Report 297, 1987. 121p, 27 fig, 12 tab, 64 ref.

Descriptors: *Groundwater, *Groundwater availability, *Hydrologic data, *Data collections, *Water resources data, *Saline water, *Texas, Water levels, Geologic formations, Water quality, Groundwater use, Encroachment, Wilcox aquifer,

Fresh to slightly saline water is available in most parts of Rusk County, which is located in the Piney Woods region of northeast Texas. The Wilcox aquifer, which underlies the entire county, was the source of most of the groundwater withdrawn during 1980. Other units capable of yielding fresh groundwater are the Carrizo, Queen City, and Sparta aquifers and the Reklaw Formation. About 5.4 million gallons per day (20,440 cubic meters per day) of groundwater was used for all purposes during 1980. Of this amount, about 78 percent was used for public supply, 10 percent for mining, about 8 percent for industrial purposes, and 4 percent for rural domestic. Water levels have declined extensively at the city of Henderson. Generally, the groundwater is of acceptable quality. Some of the near-surface beds and some of the deeper sands in the Wilcox aquifer may have become mineralized. Moderate amounts of groundwater are available for development. The amount Fresh to slightly saline water is available in m water are available for development. The amount that is available perennially is not known but is greater than the being withdrawn. (USGS) W89-02491

GROUNDWATER DATA FOR MICHIGAN-1986

Geological Survey, Lansing, MI. Water Resources For primary bibliographic entry see Field 7C. W89-02495

Group 2F-Groundwater

RECORDS OF WELLS, DRILLERS' LOGS, WATER LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUNDWATER IN HARRIS AND GALVESTON COUNTIES,

Geological Survey, Houston, TX. Water Re-For primary bibliographic entry see Field 7C. W89-02497

HYDROLOGY OF AREA 62, NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES-NEW MEXICO AND ARI-

Geological Survey, Albuquerque, NM. Water Resources Div.
F. E. Roybal, J. G. Wells, R. Gold, and J. V.

F. E. ROYOM, 3-5-7.
Flager.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 83-698, 1984, 66p, 39 fig, 11 tab, 80 ref.

Descriptors: *Coal mining, *Water quality, *Geo-hydrology, *Land use, *New Mexico, *Arizona, Surface water, Groundwater, Observation wells, Water level, Streamflow variability, Erosion, Sedientation, Little Colorado River Basin, Rio

Available hydrologic information is summarized to aid leasing decisions, and preparation of environ-mental impact studies and mine permit applications in a 9,500 square mile area located at the southern end of the Rocky Mountain Coal Province in parts of New Mexico and Arizona. Land ownership or New Mexico and Arizona. Land ownersing pattern is complicated in the area making effective management of these lands and water rights difficult. The major structural features of the area were largely developed during middle-Tertiary time. largely developed during middle-Tertiary time. Coal-bearing rocks are present in four Cretaceous rock units of the Mesaverde Group: these are: the Gallup Sandstone, the Dilco Coal Member, the Gibson Coal Member of the Crevasse Canyon Formation, and the Cleary Coal Member of the Menefee Formation. Parts of Little Colorado River Basin and Rio Grande Basin are included in the study area. The streamflow-gaging station net-work consists of 25 stations. Streamflow changes throughout the year with variation related directly to rainfall and snowmelt. Very few water quality data are available for the surface water stations to characterize the area in detail. Water levels are periodically measured at 21 observation wells and these are located mostly near Rio San Jose and northeast of Gallup, New Mexico. Depth-to-water below land surface is generally less than 200 feet. Well yields of 100 gallons per minute are common in most of the area. Groundwater quality is vari-able both within each aquifer and between aquifers. (USGS) W89-02498

HYDROLOGIC AND GEOLOGIC DATA FOR THE EDWARDS AQUIFER RECHARGE ZONE NEAR GEORGETOWN, WILLIAMSON COUNTY, TEXAS, 1986-87, Geological Survey, Austin, TX. Water Resources

M. E. Dorsey, and D. L. Slagle. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-691, 1981. 66p, 21 fig, 6 tab, 1 ref.

Descriptors: *Recharge, *Groundwater hydrology, *Surface-groundwater relations, *Edwards aquifer, *Texas, Aquifers, Water quality, Groundwater movement, Georgetown Limestone, Williamson County, Data collections, Georgetown.

This report presents a compilation and summary of data related to the interchange of water between the Edwards aquifer and streams, and to the hy-draulics of vertical movement of water in the Georgetown Limestone in the Georgetown area of Georgetown Limestone in the Georgetown area of williamson County. It presents hydrologic, geologic, hydraulic, physical, and water quality data collected from selected wells and streem sites in the study area from January 1986 to June 1987. Included are the results from six streamflow gain and loss surveys, two groundwater level surveys representing low and high water-level conditions, inorganic chemical analyses of water from selected wells and streams, and bulk specific gravity and permeability tests of cores taken at three test well permeability tests of cores taken at three test well sites. Water level altitudes differed by an average of 38 feet between low and high water-level condi-tions in the confined zone, and by an average of 13 feet in the unconfined zone. Dissolved solids of water from selected wells ranged from 320 to 1,300 milligrams per liter and from 251 to 290 milligrams per liter in water from selected streams. (USGS) per liter in W89-02499

HYDROLOGY OF AREA 59, NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES, COLORADO AND WYO-MING,

Geological Survey, Lakewood, CO. Water Resources Div. For primary bibliographic entry see Field 2E. W89-02501

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT AND VICINITY, FLORIDA, SEPTEM-

Geological Survey, Orlando, FL. Water Resources Div.

For primary bibliographic entry see Field 7C. W89-02503

RECORDS OF WELLS AND CHEMICAL ANALYSES OF GROUNDWATER IN HAND AND HYDE COUNTIES SOUTH DAKOTA, Geological Survey, Huron, SD. Water Resources

K. M. Neitzer, and N. C. Koch. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-684, 1987. 79p, 2 fig, 3 tab.

Descriptors: *Water wells, *Water quality, *Well data, *North Dakota, *Groundwater level, *Groundwater quality, Chemical analyses, Hydrologic data, Data collections.

Well and chemical groundwater data contained in three tables were collected during a 4-year study started in 1972 to determine the geology and water resources of Hand and Hyde Counties, South Dakota. Physical, hydrologic, and geologic data for 2,729 wells and test holes have been entered National Water Data Storage and Retrieval System WATSTORE. Water quality data from 300 chemical analyses has been stored in the Water Quality File of WATSTORE and is computer printed in the chemical analyses table by aquifer. (USGS) W89-02505 for 2/29 Wells and lest holes have been entered into computer storage in the Groundwater Site Inventory File of the U.S. Geological Survey's National Water Data Storage and Retrieval

PUMPAGE OF WATER IN LOUISIANA, 1985, Geological Survey, Baton Rouge, LA. Water Resources Div.

For primary bibliographic entry see Field 6D. W89-02506

HYDROLOGY OF AREA 31, EASTERN REGION, INTERIOR COAL PROVINCE, ILLI-NOIS AND INDIANA, Geological Survey, Urbana, IL. Water Resources

For primary bibliographic entry see Field 5B.

DESCRIPTION OF PIEZOMETER NESTS AND WATER LEVELS IN THE RIO GRANDE
VALLEY NEAR ALBUQUERQUE, BERNALILLO COUNTY, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Re-

sources Div S. K. Anderholm, and T. F. Bullard.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-122, 1987. 51p, 28 fig, 8 tab, 6 ref.

Descriptors: *Piezometers, *Water levels, *Groundwater level, *Rio Grande Valley, *New Mexico, Drillers logs, Drilling samples, Data col-lections, Hydrologic data, Bernalillo County, Al-

Twenty-four piezometers were installed from mid-October 1984 to mid-January 1985 in two sections of the Rio Grande valley near Albuquerque, New Mexico. Each cross section is comprised of four piezometer nests and each nest is comprised of three piezometers completed at different depths. The purpose of this report is to describe the piezo-meters nests and present some of the water level data collected from the piezometers. The piezometers nests and present some of the water level data collected from the piezometers. The piezometers were drilled using the hydraulic rotary method. The piezometers were completed with 5 feet of 60-slot wire-wound stainless steel well screen and flush joint PVC well casing. The description of each piezometer nest consists of the location of the particular piezometer nest; a figure showing the location, depth altitude, and station identification number of the piezometers in each nest; and a driller's log, geophysical logs, and description of the well cuttings from the deepest borehole in each piezometer nest. Water level altitudes generally increased from February until June 1985 in the piezometers in the Rio Bravo section. Water level altitudes in piezometers completed at different depths in a particular nest are about the same in all of the Rio Bravo nests and in the Montano 1 nest. In several of the piezometer nests, especially the Montano nests, water level altitudes decrease with depth. (USGS)

CONSTRUCTION, GEOLOGIC, AND HYDROLOGIC DATA FOR OBSERVATION WELLS IN THE REELFOOT LAKE AREA, TENNESSEE AND KENTUCKY,

Geological Survey, Nashville, TN. Water Resources Div. For primary bibliographic entry see Field 7B. W89-02510

DEVELOPMENT OF GROUNDWATER RE-SOURCES IN THE ORANGE COUNTY AREA, TEXAS AND LOUISIANA, 1980-SPRING OF

Geological Survey, Houston, TX. Water Resources Div.

C. W. Bonnet, and J. F. Williams.

C. W. Bollinet, and J. F. Williams. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 87-4158, 1987. 50p, 12 fig, 8 tab, 24 ref.

Descriptors: *Groundwater levels, *Geohydrology, *Water table, *Withdrawal, Observation wells, Chemical analyses, Water-level changes, Texas, Orange County, Newton County, Jasper County, Hardin County, Jefferson County, Louisiana, Calcasieu Parish, Cameron Parish, Chicot aquicant, Chicot aquica uifer, Specific conductivity.

This report updates groundwater information pertaining to the lower unit of the Chicot aquifer in the Orange County area, Texas and Louisiana. The period of data collection was from 1980 to the spring of 1985. Some data collected prior to 1980 are presented to establish long-term trends and relations. The lower unit of the Chicot aquifer is relations. The lower unit of the Chicot aquifer is the main source of freshwater for several cities, communities, industries, housing subdivisions, and individual homeowners in Orange County. The total pumpage from the lower unit of the Chicot aquifer in Orange County decreased from a historical maximum of 23.1 million gallons per day during 1984. The use of surface water decreased from a peak withdrawal of 58.1 million gallons per day during 1981 to 41.4 million gallons per day during 1984. Water levels rose throughout most of the area. The greatest rise in water levels (as much as 14 feet) occurred in and near the city of Orange. the area. The greatest rise in water levels (as much as 14 feet) occurred in and near the city of Orange, although the greatest decline (3 feet) occurred northwest of Vidor. Most of the water in the lower unit of the Chicot aquifer is fresh, but the water quality can vary greatly within short distances. Chloride concentrations during 1980-84 ranged from 10 to 1,700 milligrams per liter. In general, chloride concentrations remained constant during

1980-84. A relation exists between chloride concentrations and specific conductance. It was deter-mined that, estimated chloride concentrations (milmined that, estimated children concentrations (miligrams per liter) generally can be approximately determined by multiplying 0.29 times specific-conductance values (microsiemens per centimeter at 25 degrees Celsius by 0.29) when the specific conductance is between 500 and 5,600 microsiemens per centimeter at 25 degrees Celsius. (USGS) W89-02513

RELATION OF WATER CHEMISTRY OF THE EDWARDS AQUIFER TO HYDROGEOLOGY AND LAND USE, SAN ANTONIO REGION,

Geological Survey, Austin, TX. Water Resources

For primary bibliographic entry see Field 5B. W89-02514

HYDROGEOLOGY OF THE SOCORRO AND LA JENCIA BASINS, SOCORRO COUNTY, NEW MEXICO,

Geological Survey, Albuquerque, NM. Water Resources Div

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 84-4342, 1987. 62p, 15 fig. 4 plates, 10 tab, 51 ref. S. Anderholm.

Descriptors: *Areal hydrogeology, *Geohydrology, *New Mexico, Geochemistry, Geohydrologic unites, Geothermal resources, Groundwater, Aquifers, Water quality, Socorro Basin, Rio Grande, La Jencia Basin.

The Socorro and La Jencia Basins are located in central Socorro County, New Mexico. The principal aquifer system in the Socorro and La Jencia Basins consists of, in descending order, the shallow aquifer, the Popotosa confining bed, and the Popotosa aquifer. The minor aquifer systems, which are dominant along the basin margins, are the Socorro volcanics aquifer system and the Messozic-Pacional Conference of the Socorro Resin, water settem the original causifer system. zoic aquifer system. On the east side of the Socorro Basin, water enters the principal aquifer system from the Mesozoic-Paleozoic aquifer system. On the west side of the Socorro Basin, groundwater flows from the principal aquifer system in La Jencia Basin eastward to the principal aquifer system in the Socorro Basin. The volume of this flow is limited by the permeability of the minor aquifer systems and the Popotosa confining bed. A water budget indicates that if no change in groundwater storage occurs in the Socorro Basin, groundwater inflow to the basin is about 53,000 acre-feet prever year greater than groundwater source. per year greater than groundwater outflow. Dissolution of gypsum, calcite, and dolomite seems to lution of gypsum, calcite, and dolomite seems to control water quality in the Mesozoic-Paleozoic aquifer. Water with a chloride concentration of as much as 1,000 milligrams per liter and a specific conductance of as much as 6,700 microsiemens per centimeter at 25 C is present in the northern and southern parts of the Socorro Basin. These large chloride concentrations may indicate upward movement of water from deeper in the basin in these areas. The water with the large chloride concentration in the suthern part of the basin also these areas. The water with the large chloride concentration in the southern part of the basin also may be caused by leakage of geothermal waters along the Capitan Lineament. In the central part of the Socorro Basin, infiltration of excess irrigation water and inflow of groundwater from the basin margins control water quality. In this area, specific conductance generally is less than 1,000 microsismens per centimeter. Water in La Jencia Basin generally is of the calcium sodium bicarbonate true with specific conductance less than 500 microsistems. type with specific conductance less than 500 mi-crosiemens per centimeter. (USGS) W89-02517

GROUNDWATER WITHDRAWALS AND CHANGES IN GROUNDWATER QUALITY AND LAND SURFACE SUBSIDENCE IN THE HOUSTON DISTRICT, TEXAS, Geological Survey, Houston, TX. Water Resources Div.

For primary bibliographic entry see Field 6G. W89-02519

GROUNDWATER FLOW IN THE NAVAJO SANDSTONE IN PARTS OF EMERY, GRAND, CARBON, WAYNE, GARFIELD, AND KANE COUNTIES, SOUTHEAST UTAH, Geological Survey, Lakewood, CO. Water Resources Div.

Sources Liv.
E. Weiss.
Available from OFSS, USGS, Box 25425, Denver,
CO 80225. USGS Water-Resources Investigations
Report 86-4012, 1987. 41p, 14 fig. 3 tab, 14 ref.

Descriptors: *Groundwater movement, *Model studies, *Sandstone, Truncation error, Variable density flow, Geohydrology, Finite-difference

A finite-difference model of one layer was constructed to determine groundwater flow directions and magnitudes in the Navajo Sandstone of southeast Utah. Hydraulic head data, hydraulic conductivity data, precipitation data, and other data collected in the area were used in constructing and calibrating the model. Sensitivity of the model to unknown aspects of the groundwater system was canoramy the model. Sensitivity of the model to unknown aspects of the groundwater system was investigated. Simulation error attributable to grid-size error was unexpectedly large, but compared to the uncertainty in the groundwater system, simulation error was not large. (USGS) W89-02521

GROUNDWATER LEVELS IN THE ALLUVIAL AQUIFER IN EASTERN ARKANSAS, 1986, Geological Survey, Little Rock, AR. Water Resources Div. M. Plafcan.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-545, 1987. 31p, 2 fig, 1 tab, 13 ref.

Descriptors: *Groundwater level, *Alluvial aquifers, *Arkansas, *Mississippi River Valley alluvial aquifer, Alluvial aquifers, Mississippi alluvial plain, Data collections.

This report, prepared by the U.S. Geological Survey in cooperation with the Arkansas Soil and Water Conservation Commission, the U.S. Soil Conservation Service, and local Conservation Dis-Conservation Service, and local Conservation Dis-tricts, contains groundwater level measurements of 512 wells tapping the Mississippi River Valley alluvial aquifer of eastern Arkansas. The measure-ments were made by district Soil Conservation Service personnel during 1986. The purpose of this report is to provide these data to other State and Federal agencies as well as to private landowners. The shallowest pre-pumping water levels occurred. Federal agencies as well as to private landowners. The shallowest pre-pumping water levels occurred in Clay, Independence, Mississippi, and Randolph Counties where the average depth to water was 15 feet or less. The deepest water levels occurred in interstream areas where groundwater withdrawals were the greatest. Water levels of 100 feet or greater below land surface were measured in Arkansas, Cross, Lonoke, Poinsett, and Prairie Counties. Water level measurements made during the post-pumping (recovery) season averaged about 3 feet less than those made during the pre-pumping season. (USGS) season. (USGS) W89-02522

GROUNDWATER LEVELS IN WYOMING, 1976 THROUGH 1985,
Geological Survey, Cheyenne, WY. Water Re-

sources Div.

For primary bibliographic entry see Field 7C. W89-02525

MAP SHOWING GROUNDWATER LEVELS IN ANCHORAGE, ALASKA, 1985, Geological Survey, Anchorage, AK. Water Re-

sources Div. For primary bibliographic entry see Field 7C. W89-02526

SELECTED WATER-QUALITY DATA FOR THE MURTAUGH LAKE AREA, SOUTH CEN-TRAL IDAHO, JUNE 1987, Geological Survey, Boise, ID. Water Resources Discourage of the Company of the Co

For primary bibliographic entry see Field 7C.

W89-02530

SELECTED HYDROGEOLOGIC DATA FOR THE SOUTHWEST GLENDIVE PRELIMI-NARY LOGICAL MINING UNIT AND ADJA-CENT AREAS, DAWSON COUNTY, MON-TANA,

Geological Survey, Honolulu, HI. Water Resources Div.

For primary bibliographic entry see Field 7C. W89-02531

POTENTIOMETRIC SURFACE OF THE IN-TERMEDIATE AQUIFER SYSTEM, WEST-CENTRAL FLORIDA, SEPTEMBER 1986, Qeological Survey, Tampa, FL. Water Resources

For primary bibliographic entry see Field 7C. W89-02532

DATA ON GROUNDWATER QUALITY FOR THE MCDERMITT ONE DEGREE X TWO DEGREE QUADRANGLE, NORTHERN NEVADA.

Geological Survey, Carson City, NV. Water Resources Div. For primary bibliographic entry see Field 7C. W89-02537

DATA ON GROUNDWATER QUALITY FOR THE LOVELOCK ONE DEGREE X TWO DEGREE QUADRANGLE, WESTERN NEVADA

Geological Survey, Carson City, NV. Water Resources Div. For primary bibliographic entry see Field 7C. W89-02538

DATA ON GROUNDWATER QUALITY FOR THE WINNEMUCCA ONE DEGREE X TWO DEGREE QUADRANGLE, CENTRAL

Geological Survey, Carson City, NV. Water Resources Div. For primary bibliographic entry see Field 7C. W89-02539

DATA ON GROUNDWATER QUALITY FOR THE RENO ONE DEGREE X TWO DEGREE QUADRANGLE, WESTERN NEVADA, Geological Survey, Carson City, NV. Water Re-sources Div

For primary bibliographic entry see Field 7C. W89-02540

DATA ON GROUNDWATER QUALITY FOR THE WALKER LAKE ONE DEGREE X TWO DEGREE QUADRANGLE, WESTERN NEVADA AND EASTERN CALIFORNIA,

Geological Survey, Helena, MT. Water Resources For primary bibliographic entry see Field 7C. W89-02541

DATA ON GROUNDWATER QUALITY FOR THE TONOPAH ONE DEGREE X TWO DEGREE QUADRANGLE, CENTRAL

Geological Survey, Carson City, NV. Water Resources Div. For primary bibliographic entry see Field 7C. W89-02542

DATA ON GROUNDWATER QUALITY FOR THE WESTERN NEVADA PART OF THE GOLDFIELD ONE DEGREE X TWO DEGREE OUADRANGLE.

Geological Survey, Carson City, NV. Water Resources Div. For primary bibliographic entry see Field 7C. W89-02543

Group 2F-Groundwater

DATA ON GROUNDWATER QUALITY FOR THE CALIENTE ONE DEGREE X TWO DEGREE QUADRANGLE, EASTERN NEVADA, Geological Survey, Carson City, NV. Water Resources Div.

For primary bibliographic entry see Field 7C. W89-02544

DATA ON GROUNDWATER QUALITY FOR THE WESTERN NEVADA PART OF THE DEATH VALLEY ONE DEGREE X TWO DEGREE QUADRANGLE,

Geological Survey, Carson City, NV. Water Resources Div. For primary bibliographic entry see Field 7C. W89-02545

DATA ON GROUNDWATER QUALITY FOR THE SOUTHERN NEVADA PART OF THE KINGMAN ONE DEGREE X TWO DEGREE QUADRANGLE,

Geological Survey, Carson City, NV. Water Resources Div.

For primary bibliographic entry see Field 7C. W89-02546

ADVISORY SYSTEM FOR NORTH CAROLINA GROUNDWATER QUALITY MODELING AND MANAGEMENT NEEDS, Duke Univ, Durham, NC. Dept. of Civil and Environmental Engineering. For primary bibliographic entry see Field 5G. W89-02548

WATER RESOURCES INVESTIGATIONS IN TENNESSEE: PROGRAMS AND ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY, 1987-

Geological Survey, Nashville, TN. Water Re-

For primary bibliographic entry see Field 7C. W89-02559

SELECTED GEOHYDROLOGIC CHARACTER-ISTICS OF THE PATAPSCO AQUIFER AT CHALK POINT, PRINCE GEORGES COUNTY, MARYLAND.

Maryland Geological Survey, Baltimore. F. K. Mack.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. Maryland Geological Survey Open-File Report 88-02-4 (U.S. Geological Survey Open-File Report 87-227), 1988. 36p, 16 fig, 5 tab, 11 ref.

Descriptors: *Geohydrology, *Maryland, *Artesian aquifers, *Coastal Plain, *Water supply, Wells, Water levels, Transmissivity, Maryland Coastal Plain, Prince Georges County, Charles County, Patapsco aquifers, Calvert County.

The Cretaceous Patapsco Formation at Chalk Point consists of thick beds of clay and silt that separate sandy intervals of varying lateral extent. Water bearing characteristics of three sand layers, the tops of which are at depths of about 850 feet, 1,000 feet, and 1,500 feet, have been estimated by pumping tests. The estimated transmissivity of each was 570, 1,500, and 820 feet squared per day, respectively, at the sites tested. Water levels in the 850-foot sand declined from 10 feet above sea level to 17 feet below sea level ept from 1974 to 1986. Water 850-foot sand declined from 10 feet above sea level to 17 feet below sea level from 1974 to 1986. Water levels in the 1,000-foot sand, which has been pumped since 1975 at rates ranging from zero to 0.8 million gallons per day, have declined from 15 feet above sea level to 23 feet below sea level from 1973 to 1986. Water levels in the 1,500-foot sand, which has not been pumped, have declined from 15 feet above sea level to 1 foot below sea level from 1973 through 1986. Chemical analyses of water samples show that except for the slightly high concentrations of dissolved iron in the 850-foot and 1,000-foot sands, all constituents tested foot and 1,000-foot sands, all constituents tested met the drinking-water standards of the U.S. Envi-ronmental Protection Agency. (USGS) W89-02560

EFFECTS OF FLUCTUATING RIVER-POOL STAGES ON GROUNDWATER LEVELS IN

THE ADJACENT ALLUVIAL AQUIFER IN THE LOWER ARKANSAS RIVER, ARKANSAS, Geological Survey, Little Rock, AR. Water Resources Div.

sources Div. D. A. Freiwald, and G. D. Grosz. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 87-4279, Dec. 1987. 22p, 9 fig, 3 tab, 4 ref.

Descriptors: *Rising stage, *Groundwater level, *Surface groundwater relations, *Water level fluc-tuations, Alluvial aquifer, Arkansas River, Arkan-sas, Impoundment effect.

The U.S. Geological Survey conducted a study in cooperation with the U.S. Army Corps of Engineers to determine the effect of fluctuating the lower Arkansas River. A network of 41 wells was lower Arkansas Kiver. A network of 41 wells was used to delineate 4 cross sections adjacent to river pools 2 and 5 of the McClellan-Kerr Arkansas River Navigation System to examine groundwater levels at various distances from the river. The hydraulic gradient of water levels in the alluvial nydraulic gradient of water levels in the anuviar aquifer along these cross sections indicates that the river is losing water to the adjacent aquifer. The effect on groundwater levels in the alluvial aquifer caused by pool-stage fluctuations was most pro-nounced at distances less than about 2 miles from nounced at distances less than about 2 miles from the Arkansas River. At distances greater than about 2 miles, the changes in groundwater levels probably were the result of water levels rising in the aquifer since the heavy summer irrigation withdrawals have ceased. An equation useful for estimating the distribution of head changes, was applied to the study area to estimate the effect of a 1-foot rise in pool stage on water levels in the adjacent alluvial aquifer after equilibrium conditions have been established. The theoretical head change (rise) in the aquifer was estimated to ranse change (rise) in the aquifer was estimated to range from 1-foot at the Arkansas River to 0.57 foot at a distance of 5 miles away from the river. (USGS)

GEOHYDROLOGY AND SUSCEPTIBILITY OF MAJOR AQUIFERS TO SURFACE CONTAMI-NATION IN ALABAMA; AREA 9,

Geological Survey, Tuscaloosa, AL. Water Resources Div. For primary bibliographic entry see Field 5B. W89-02563

GEOHYDROLOGY AND SUSCEPTIBILITY OF MAJOR AQUIFERS TO SURFACE CONTAMI-NATION IN ALABAMA; AREA 8, Geological Survey, Montgomery, AL. Water Re-

For primary bibliographic entry see Field 5B. W89-02564

ELECTED HYDROLOGIC DATA FOR PAH-VANT VALLEY AND ADJACENT AREAS, MIL-LARD COUNTY, UTAH, 1987,

Geological Survey, Denver, CO. For primary bibliographic entry see Field 7C. W89-02569

WATER RESOURCES INVESTIGATIONS IN TENNESSEE: PROGRAMS AND ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY, 1987-

Geological Survey, Nashville, TN. Water Re-For primary bibliographic entry see Field 9C. W89-02570

SELECTED GROUNDWATER INFORMATION FOR THE COLUMBIA PLATEAU REGIONAL AQUIFER SYSTEM, WASHINGTON AND OREGON, 1982-1985: VOLUME I, GEOHYDRO-

LOGY, Geological Survey, Tacoma, WA. Water Re-For primary bibliographic entry see Field 7C. W89-02572

SELECTED GROUNDWATER INFORMATION FOR THE COLUMBIA PLATEAU REGIONAL

AQUIFER SYSTEM, WASHINGTON AND OREGON, 1982-1985: VOLUME II, WATER

Geological Survey, Tacoma, WA. Water Resources Div. For primary bibliographic entry see Field 7C. W89-02573

WATER RESOURCES ACTIVITIES OF THE U, S, GEOLOGICAL SURVEY IN TEXAS - FISCAL **VEAR 1987.**

Geological Survey, Austin, TX. Water Resources

For primary bibliographic entry see Field 9C. W89-02574

GENERALIZED POTENTIOMETRIC SUR-FACE OF THE SPARTA-MEMPHIS AQUIFER, EASTERN ARKANSAS, SPRING 1980, Geological Survey, Little Rock, AR. Water Resources Div

For primary bibliographic entry see Field 7C. W89-02575

GEOHYDROLOGY AND SUSCEPTIBILITY OF COLDWATER SPRING AND JACKSONVILLE FAULT AREAS TO SURFACE CONTAMINATION IN CALHOUN COUNTY, ALABAMA, Geological Survey, Montgomery, AL. Water Resources Div.

For primary bibliographic entry see Field 5B. W89-02576

GEOHYDROLOGY AND SUSCEPTIBILITY OF MAJOR AQUIFERS TO SURFACE CONTAMI-NATION IN ALABAMA, AREA 7,

Geological Survey, Tuscaloosa, AL. Water Resources Div. For primary bibliographic entry see Field 5B. W89-02577

GEOHYDROLOGY AND SUSCEPTIBILITY OF MAJOR AQUIFERS TO SURFACE CONTAMINATION IN ALABAMA, AREA 1, Geological Survey, Tuscaloosa, AL. Water Re-

sources Div. For primary bibliographic entry see Field 5B. W89-02578

GROUNDWATER RESOURCES OF LIME-STONE COUNTY, TEXAS, Geological Survey, Austin, TX. Water Resources

Div

Available from OFSS, USGS, Box 25425, Denver, CO 80225. Texas Department of Water Resources 299, 1987. 97p, 20 fig, 11 tab, 43 ref.

Descriptors: *Groundwater, *Water quality, *Artificial recharge, *Water resources data, *Limestone County, *Texas, Water table, Artesian wells, Aquifer characteristics, Groundwater recharge, Data collections, Wilcox Formation.

collections, Wilcox Formation.

Limestone County in east-central Texas has small to plentiful groundwater supplies available, depending upon the location within the county. The Wilcox Group in the eastern part of the county has adequate supplies to meet the expected future water demands. The thicker zones of the Wilcox Group can support well yields in excess of 100 gallons per minute from the Tehuacana Member of the Kincaid Formation. The Taylor Marl and Navarro Group furnish only small quantities of groundwater to wells in the western part of the county. About 0.9 million gallons per day of groundwater was used for all purposes in 1980. This use has declined since 1955 but is expected to increase as additional public-supply and industrial wells are being developed. The Wilcox Group is capable of annually yielding at least 14,000 acrefect or 11.6 million gallons per day of water to wells on a long-term basis. Generally, the groundwater is of acceptable quality for most uses. Relatively high dissolved-solds and iron concentrations are the major water quality problems. Water qualare the major water quality problems. Water quality problems that may be the result of man's activi-ties are limited to a small oilfield area near Mexia. (USGS) W89-02583

CONTRIBUTION OF TOXIC ("EMICALS TO GROUNDWATER FOR DOME: AIC ON-SITE SEWAGE DISPOSAL SYSTEMS, Connecticut Univ., Storts. Inst. of Water Re-

For primary bibliographic entry see Field 5B. W89-02584

HYDROLOGIC ANALYSIS OF THE RIO GRANDE BASIN NORTH OF EMBUDO, NEW MEXICO, COLORADO AND NEW MEXICO, Geological Survey, Denver, CO. Water Resources

DIV. G. A. Hearne, and J. D. Dewey. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 86-4113, 1988. 244p, 39 fig, 30 tab, 130 ref.

Descriptors: *New Mexico, *Model studies, *Geo-hydrology, *Alluvial aquifers, *Hydrologic budget, *Surface-groundwater relations, *Rio Grande, Evapotranspiration, Precipitation excess, Groundwater, Groundwater movement, Rio Grande Rift, San Luis basin, San Luis Valley, Colorado Costilla Plains, Sunshine Valley, New Mexico, Sand Juan Mountains, Sangre de Cristo Mountains, Taos Plateu, San Luis Hills.

Water yield was estimated for each of the five regions that represent contrasting hydrologic regimes in the 10,400 square miles of the Rio Grande basin above Embudo, New Mexico. Water yield was estimated as 2,800 cubic feet per second for the San Juan Mountains, and 28 cubic feet per second for the Taos Plateau. Evapotranspiration exceeded precipitation by 150 cubic feet per second on the Costilla Plains and 2,400 cubic feet per second on the Alamosa Basin. A three-dimensional model was constructed to represent the acuiper second on the Alamosa basin. A three-dimen-sional model was constructed to represent the aqui-fer system in the Alamosa Basin. A preliminary analysis concluded that: (1) a seven-layer model representing 3,200 feet of saturated thickness could accurately simulate the behavior of the flow equation; and (2) the 1950 condition was approximately stable and would be a satisfactory initial condition. Reasonable modifications to groundwater with-drawals simulated 1950-79 water-level declines urawais simulated 1950-79 water-level declines close to measured value. Sensitivity tests indicated that evapotranspiration salvage was the major source, 69 to 82 percent, of groundwater withdrawals. Evapotranspiration salvage was projected to be the source of most withdrawals. (USGS) W89-02589

GEOHYDROLOGY AND SUSCEPTIBILITY OF MAJOR AQUIFERS TO SURFACE CONTAMINATION IN ALABAMA, AREA 6, Geological Survey, Tuscaloosa, AL. Water Re-

sources Div. For primary bibliographic entry see Field 5B. W89-02590

JANUARY 1987 WATER LEVELS, AND DATA RELATED TO WATER LEVEL CHANGES, WESTERN AND SOUTH-CENTRAL KANSAS, Geological Survey, Lawrence, KS. Water Re-

Geological sources Div. B. J. Dague.

Available from OFSS, USGS, Box 25425, Denver,

CO 80225. USGS Open-File Report 87-241, 1987. 161p, 2 fig, 1 tab, 18 ref.

Descriptors: *Groundwater, *Kansas, *Hydrologic data, Water level fluctuations, Data collections.

Hydrologic data related to water level measurements were collected in observation wells in western and south-central Kansas. The measurements were made in midwinter when pumping was minimal and water levels had recovered, for the most part, from the effects of pumping during the previ-ous irrigation season. Annual hydrologic data are provided for relating water level changes from a "base-reference year" (predevelopment year), a year

of abnormally large amounts of precipitation and minimum pumpage (1966 or 1974), and each of seven consecutive years of measurement (1980-86). The 'base-reference year' is designated as 1940 for the southwestern area, 1944 for the south-central area, and 1950 for the northwestern, west-central, and Equus beds areas. Data also are provided for relating the average annual water-level changes, saturated thickness. (USGS) W89-02594

SEASONAL CHANGES IN GROUNDWATER LEVELS IN THE SHALLOW AQUIFERS NEAR HAGERMAN AND THE PECOS RIVER, CHAVES COUNTY, NEW MEXICO, Geological Survey, Albuquerque, NM. Water Re-sources Div.

For primary bibliographic entry see Field 4B. W89-02601

GEOPHYSICAL LOGS AND HYDROLOGICAL DATA FOR EIGHT WELLS IN THE COYOTE SPRING VALLEY AREA, CLARK AND LINCOLN COUNTIES, NEVADA, Geological Survey, Carson City, NV. Water Resources Div.

For primary bibliographic entry see Field 4B. W89-02603

REACTIONS AND TRANSPORT OF TRACE METALS IN GROUNDWATER, Clarkson Univ., Potsdam, NY. Dept. of Civil and Environmental Engineering. For primary bibliographic entry see Field 5B. W89-02644

GROUND WATER QUALITY AND AGRICUL-TURAL PRACTICES. For primary bibliographic entry see Field 3F. W89-02654

U.S.D.A. AGRICULTURAL RESEARCH SERV-ICE COMMITMENT TO GROUND WATER

RESEARCH, Agricultural Research Service, Bushland, TX. For primary bibliographic entry see Field 3F. W89-02653

NATIONAL SURVEY OF PESTICIDES IN DRINKING WATER WELLS,

DC. Office of Drinking Water. For primary bibliographic entry see Field 5B. W89-02656

GROUND WATER CONSERVATION TECHNIQUES: POTENTIAL IMPACTS ON WATER USAGE AND QUALITY, Oklahoma State Univ., Stillwater. Dept. of Agri-

cultural Economics. For primary bibliographic entry see Field 3F. W89-02658

EFFECTS OF IRRIGATION PRACTICES ON STREAM-CONNECTED PHREATIC AQUIFER SYSTEMS, Oklahoma Univ., Norman. Dept. of Civil Engineering and Environmental Science. For primary bibliographic entry see Field 3F. W89-02661

GROUND WATER CONTAMINATION FROM SALTWATER INTRUSION AND LIMITATIONS ON AGRICULTURAL ACTIVITIES, North Texas State Univ., Denton. Inst. of Applied

For primary bibliographic entry see Field 5B. W89-02662

IMPACTS OF AGRICULTURAL CHEMICALS ON GROUND WATER QUALITY IN IOWA, Geological Survey, Iowa City, IA. For primary bibliographic entry see Field 5B.

W89_02668

ASSESSING SOME POTENTIALS FOR CHANGING AGRONOMIC PRACTICES AND IMPROVING GROUND WATER QUALITY: IMPLICATIONS FROM A 1984 IOWA

Iowa State Univ., Ames.
For primary bibliographic entry see Field 5G.
W89-02669

INVESTIGATION OF NITRATE CONTAMINATION IN SHALLOW GROUND WATERS NEAR WOODWARD, OKLAHOMA,

Oklahoma Water Resources Board, Oklahoma City. For primary bibliographic entry see Field 5B. W89-02671

NATIONAL ASSESSMENT OF GROUND WATER CONTAMINATION FROM PESTI-CIDES AND FERTILIZERS, NATIONAL

Oklahoma Univ., Norman. Environmental and Ground Water Inst. For primary bibliographic entry see Field 5B. W89-02673

QUANTITATIVE STUDIES OF BIODEGRADA-TION OF PETROLEUM AND SOME MODEL HYDROCARBONS IN GROUND WATER AND SEDIMENT ENVIRONMENTS,

Bemidji State Univ., MN. Center for Environmen-

For primary bibliographic entry see Field 5B. W89-02674

INCENTIVES AND INSTITUTIONS TO REDUCE PESTICIDE CONTAMINATION OF GROUND WATER,
California Univ., Berkeley. Dept. of Agricultural

and Resource Economics.
For primary bibliographic entry see Field 5G.
W89-02677

POULTRY MANURE MANAGEMENT AND GROUND WATER QUALITY: THE DELAWARE SOLUTION,

Delaware Univ., Newark. Coll. of Agricultural

For primary bibliographic entry see Field 5G. W89-02678

NITROGEN AND GROUND WATER PROTEC-

Agricultural Research Service, Durant, OK. For primary bibliographic entry see Field 5G. W89-02679

GROUND WATER AND AGRICULTURE: ADDRESSING THE INFORMATION NEEDS OF PENNSYLVANIA'S CHESAPEAKE BAY PRO-

Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 5G. W89-02680

DEVELOPING A STATE GROUND WATER POLICY IN THE CORN BELT: THE IOWA CASE,

IT Corp., Monroeville, PA.
B. P. Borofka, C. S. Cousins-Leatherman, and R. D. Kelley.

D. Reney. In: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p 389-395, 3 fig.

Descriptors: *Water policy, *State jurisdiction, *Management planning, *Water pollution control, *Groundwater pollution, *Agriculture, *lowa, Agricultural watersheds, Wells, Nitrate.

Group 2F-Groundwater

An overall groundwater protection strategy which assesses all potential sources of groundwater con-tamination including those associated with agricultamination including those associated with agriculture was developed in Iowa. Surveys indicate that
68 percent of all municipal drinking water in Iowa
is derived from groundwater as well as approximately 100 percent of the private rural drinking
water. There are several studies which indicate
that nitrate contamination is more than a surface
water or runoff problem in Iowa. The problem is
getting more serious as rates of fertilizer appreciation increase. The problem may not be limited to
shallow groundwater exclusively. Due to the presence of fractured bedrock in parts of Iowa, agriculrural drainage, wells were commonly used for ence of fractured bedrock in parts of Iowa, agricultural drainage wells were commonly used for draining wetlands to create cultivated farmland. A preliminary survey of public water supplies found detectable residues of commonly used pesticides in 57 percent of the wells sampled. Several types of pesticides have been routinely detected, including five herbicides and three insecticides: atrazine, bladex, sencor, dual, lasso, dyfonate, counter, and bolstar. A goal has been set for Iowa's Ground Water Protection Strategy: to develop a unified approach among all federal, state, and local programs in Iowa in order to prevent groundwater contamination, to restore groundwater quality in areas where pollution has occurred and to maintain contamination, to restore groundwater quanty in areas where pollution has occurred and to maintain an adequate supply of acceptable quality groundwater for Iowa's projected uses and demands. The strategy development steps include: identification of the problem; identification of policy and program alternatives; selection of management options; application of the technical assessment. Severally, and the property of the problems of the second of the problems. eral pieces of environmental legislation were passed by the Iowa House and Senate. Several bills are waiting for the governor's signature: landfill ban by 1997; a one-time test of municipal water supplies for pesticides; testing of bottle water for contaminants; testing/certification of home water contaminants; testing/certification of home water treatment devices; and proposed use of the Exxon Rebate for education and demonstration project. The end results would lead to conservation of natural gas and gasoline, as well as protection of the groundwater. (See also W89-02654) (Davis-PTT) W89-02681

GROUNDWATER HYDROLOGY, Rijksinstituut voor de Volksgezondheid en Milieu-hygiene, Bilthoven (Netherlands). Lab. for Soil and Groundwater. and Ground W. Cramer.

IN: Hydrology 2000. International Association of Hydrological Sciences, Inst. of Hydrology, Wal-lingford, England. IAHS Publication No. 171,

Descriptors: *Geohydrology, *Groundwater, *Research priorities, Hydrology, Groundwater depletion, Saline water intrusion, Groundwater pollution, Geothermal studies, Groundwater manage-

Awareness is growing of the problems associated with overdrawn aquifers and of the unwanted sideeffects of groundwater exploitation, such as subsid-ence, salt water intrusion, reduction in crop yield and a decrease in surface water discharge. The current scope of groundwater hydrology is ex-tremely wide and the research field is quite dynamtremely wide and the research field is quite dynamic as a result of academic challenges as well as current problems relating to water supply, environmental protection and subsurface engineering activities (i.e., groundwater exploitation, brackish or saline water intrusion, subsidence, agricultural production, soil and groundwater pollution, geological disposal, in situ conditions, geothermal energy, natural environment, groundwater management). On the basis of the achievements so far, we may have gained a fair concernal understand. we may have gained a fair conceptual understand-ing of the entities, structure and processes which ing of the entities, structure and processes which constitute hydrogeological systems. One of the greatest challenges in the coming years lies in the urgent need to quantify the parameters which characterize these systems at different scales and with the required reliability. (See also W89-02717) (Lantz-PTT) W89-02720

NEW DIRECTIONS IN KARST.

Proceedings of the Anglo-French Karst Symposium, Symposium 1983. Geo Books, Norwich, Engum, Symposium land. 1986. 613p.

Descriptors: *Karst, *Karst hydrology, *Geohydrology, *Sinks, Chemical properties, Geomorphology, Alkalinity, Tropical regions, Limestone, Groundwater movement, Aquifers, Geology, Radioactive tracers, Caves

The Anglo-French Karst Symposium was held in England and also in Wales in 1983 with the collaboration of the Association Francaises du Karsto-logie. The theme of the Symposium was New Directions in Karst and the intention was to demlogie. The theme of the Symposium was New Directions in Karst and the intention was to demonstrate both in the paper sessions and the field excursions the application and relevance of contemporary methods and techniques in karst geomorphology. The papers reflected the use of many of the modern tools employed in karsts including isotope and radiometric dating techniques, palynology and hydrochemical methods. Some papers discussed the more detailed work being carried out in tropical areas and the Peoples Republic of China. Interest in the developing field of biological erosion was highlighted by several of the studies one of which raised the issue of a morphologically distinct phytokarst. A renewed interest in the long-term evolution of karst is seen in the papers on paleokarst and in the field excursion to South Wales. The papers are grouped under seven sections: karst processes, karst rocks and structures, karst hydrology, karst caves, tropical karst, karst tions: karst processes, karst 10kas and state-takes karst hydrology, karst caves, tropical karst, karst pavements, and the evolution of karsts. (See W89-02729 thru W89-02742) (Geiger-PTT)

ALKALINITY MEASUREMENTS IN KARST WATER STUDIES, Lancaster Univ. (England). Dept. of Geography. L. Rose, and P. Vincent. IN: New Directions in Karst. Geo Books, Norwich, England. 1986. p 1-15, 1 fig, 5 tab, 15 ref,

Descriptors: *Water analysis, *Karst, *Karst hydrology, *Alkalinity, Chemical properties, Hydrogen ion concentration, Spring water, Carbon dioxide, Calcium, Magnesium, Vegetation effects, Picknett-Trombe simulation, Gait Barrows National Nature Reserve, England.

A rigorous but simple titrimetric method for the determination of the alkalinity of karst waters is described. Alkalinity is here defined as a measure of dissolved Caf(Mg)COJ. Standard calcium/magnesium estimations measure these cations from all sources. Alkalinity does not change when CO2 is added or removed. Spring waters which emerge from the base of pavements at Gait Barrows National Nature Reserve are very close to Picknett/ Trombe saturation. Downstream pH rises without any change in the alkalinity of the waters. From the alkalinity measurements, the saturation conditions of the spring water, and hence a minimum the aikinity measurements, the saturation condi-tions of the spring water, and hence a minimum pCO2 were calculated. Variation in pCO2 among the spring waters is attributable to the variation in soil/vegetation cover of the respective catchment areas. (See also W89-02728) (Author's abstract) W89-02729

CONTROLS ON THE COMPOSITION OF AUTHIGENIC PERCOLATION WATER IN THE BURREN, IRELAND,

Bristol Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2K. W89-02730

CHEMICAL WEATHERING OF THE EAST YORKSHIRE CHALK, London Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2K. W89-02731

PHYTOKARST, BLUE-GREEN ALGAE AND LIMESTONE WEATHERING, University Coll., London (England). Dept. of Ge-

ography.
For primary bibliographic entry see Field 2K.

W89-02732

GEOLOGICAL STRUCTURE: AN IMPORTANT FACTOR CONTROLLING KARST DEVELOP-MENT,

Academia Sinica, Beijing (China). Inst. of Geogra-

IN: New Directions in Karst. Geo Books, Nor-wich, England. 1986. p 165-174, 5 fig, 1 tab, 10 ref.

Descriptors: *Geohydrology, *Geologic structure, *Karst, *Geology, *Karst hydrology, Geomorpho-logy, Carbon dioxide, Limestone, Carbonates, Geologic fractures, Springs, Caves, Tectonics.

The effect of geological structures on karst development has been systematically studied. It is possible that geological structure is more important for karst development than the lithology of carbonate rocks, types of hydrocirculation, pCO2 and climatic factors such as temperature and precipitation. The nature of regional tectonics determines the spatial distribution characteristics of carbonate cooks and host development. The agreement of spatial distribution characteristics of carbonians rocks and karst development. The arrangement of formations affects the spatial location of karst, which is generally in more soluble rocks near the contact zone between two kinds of lithology. Syncontact zone between two kinds of lithology. Synclines commonly constitute the collecting and storing structures of karst water, and surface and subsurface karst often develops. Anticlines usually form the dividing structures between surface and subsurface water. When the rocks are fractured and destroyed by tectonic movements karst may develop well. The axial parts of folds are the places where stress concentrates, and deformation is strong; there the zone of karst water abounds and karst develops. It is obvious that most branches and main passages of underground drainage systems, poljes, and big springs are connected with fractures and correlate with faults. The existence of deep and big faults promotes deep water ence of deep and big faults promotes deep water circulation and karst development. (See also W89-02728) (Author's abstract)

STABLE ISOTOPES: AN INVESTIGATION INTO THEIR APPLICATION IN KARST HYDROLOGY IN THE U.K., WITH SPECIAL REERENCE TO THE MALHAM AREA, NORTH VORKSHIRE.

Oxford Univ. (England). Dept. of Geography. H. A. Brown, M. M. Sweeting, and R. L. Otlet. IN: New Directions in Karst. Geo Books, Norwich, England. 1986. p 213-231, 10 fig. 1 tab, 23

Descriptors: *Tracers, *Groundwater movement, *Yorkshire, *England, *Karst hydrology, *Isotopic tracers, Springs, Oxygen, Groundwater recharge, Seasonal variation, Mixing, Oxygen iso-

Natural variations in stable isotopes in the hydrological cycle have provided valuable information in many areas worldwide, and most successfully where extremes of climatic seasonality or relief exist. A project was initiated to assess the viability of the technique in the United Kingdom. Oxygen isotope results are presented for the Malham area, North Yorkshire. The isotopic input in monthly precipitation was found to be only weakly seasonal, although the range of variations is significantly (approximately 100 times) larger than the estimated measurement error. A finer structure was revealed at shorter timescales, and this may be of relevance for detailed hydrological tracing, especially if suitable input spikes could be predicted reliably. Variations of input with altitude, however, were found to be erratic. Monthly samples of ground and surface waters exhibited relatively smaller delta Oxygen (18) isotope variations, indicating early mixing and storage of waters in the soil and/or upper karstic zone, with some evidence of the persistance of winter recharge. The complexity of the mixing process is exemplified in an examination of a storm hydrograph at Waterhouses Spring, where the marked chemical response is distinct from the small isotopic variations observed. In contrast with the smoothing of the input signal in

Groundwater-Group 2F

groundwater, a robust, naturally enhanced and clearly seasonal isotope signal was discovered in the waters of Malham Tarn (a natural lake), and the waters of Malham Tarin (a natural lake), and this suggests a useful application in the study of leakage from, and interconnections with, surface storage water bodies. It is concluded that although the isotope technique reveals information not ob-tainable by conventional hydrological methods, it is unlikely that it could ever be used in isolation and is more correctly regarded, therefore, as a new dimension rather than a new direction in karst hydrology. (See also W89-02728) (Author's ab-stract) stract) W89-02734

STORMFLOW CHARACTERISTICS OF THREE SMALL LIMESTONE DRAINAGE BASINS IN NORTH ISLAND, NEW ZEALAND, Manchester Polytechnic (England). Dept. of Environmental and Geographical Studies. For primary bibliographic entry see Field 2A. W89-02735

GROUNDWATER FLOW IN THE LOWLAND LIMESTONE AQUIFER OF EASTERN CO. GALWAY AND EASTERN CO. MAYO, WESTERN IRELAND, Rochester Univ., NY. Inst. of Optics. C. Coxon, and D. P. Drew. IN: New Directions in Karst. Geo Books, Norwich, England. 1986. p 259-279, 8 fig. 1 tab, 10 ref.

Descriptors: *Aquifers, *Limestone, *Groundwater movement, *Karst hydrology, *Ireland, Karst, Dye releases, Tracers, Geohydrology, Geomorphology, Intermittent lakes, Turloughs.

The western part of the central lowland of Ireland in eastern County Galway, eastern County Mayo and County Roscommon, is an area of subdued topography rarely rising over 60 m above sea level. It is underlain by Carboniferous limestone mantled with varying thicknesses of glacial and fluvioglacial material. The landforms are in part of glacial origin and in part karstic, and include many turloughs (seasonal lakes). Techniques from karst hydrology (e.g., dve tracing) and from conventional geohydrology (e.g., water table mapping from borehole data) have been used in the area. These have demonstrated that the groundwater hydrology is intermediate in type between a non-karstic diffuse flow aquifer, and the conduit dominated groundwater flow system characteristic of most karstic terrains. (See also W89-02728) (Author's abstract) The western part of the central lowland of Ireland

KARST WATER TEMPERATURE AND THE SHAPING OF MALHAM COVE, YORKSHIRE, A. F. Pitty, J. L. Ternan, R. A. Halliwell, and J. Crowther.

IN: New Directions in Karst. Geo Books, Nor-wich, England. 1986. p 281-291, 1 fig, 31 ref.

Descriptors: *Karst hydrology, *Karst, *Springs, *Water temperature, Advection, Sinks, Limestone, Caves, Geology, Geomorphology, England, Floods, Glacial lakes, Glacial aquifers.

Fluctuations in karst water temperatures from 15 sampling sites in the Malham area of northwest Yorkshire are presented. Springs draining into Malham Tarn have narrow temperature ranges (standard deviations = 0.12 to 0.22 C), with a mean value of 7.39 C. The possibility of lake water, formerly ponded beneath and behind glacier ice, being periodically released by advection is discussed. The role of such abrupt, large-scale releases in the shaping of spectacular limestone landforms in the vicinity is considered. (See also W89-02728) (Author's abstract)

CHEMICAL EROSION IN TOWER KARST TERRAIN, KINTA VALLEY, PENINSULAR MALAYSIA, Saint David's Univ. Coll., Lampeter (Wales).

Dept. of Geography.
For primary bibliographic entry see Field 2J.

HYDROLOGICAL DEVELOPMENT OF TROP-ICAL TOWER KARST: AN EXAMPLE FROM PENINSULAR MALAYSIA,

W89-02738

IN: New Directions in Karst. Geo Books, Norwich, England. 1986. p 443-459, 5 fig, 1 tab, 33 ref.

Descriptors: *Karst hydrology, *Tropical regions, *Karst, *Malaysia, *Paleohydrology, Erosion, Drainage area, Groundwater movement, Geomorphology, Geology, Sedimentation, Caves.

pnology, Geology, Sedimentation, Caves.

Studies of the morphology and sedimentary infill of abandoned drainage networks in tropical karst towers in Selangor, Peninsular Malaysia have enabled four major phases of hydrological development to be recognized. These have allowed a partial reconstruction of the sequence of landform and drainage development in the area. The available evidence suggests that this development began during or prior to the Lower Quaternary, indicating a considerable age for tower karst formation in the region. The fossil drainage networks therefore provide an indication of environmental conditions during a period within which little is known of environmental history in Peninsular Malaysia, confirming the value of karst features for palaeconvironmental reconstruction in areas which have experienced long histories of erosion. (See also W89-02739

LIMESTONE WEATHERING UNDER A SOIL COVER AND THE EVOLUTION OF LIMESTONE PAVEMENTS, MALHAM DISTRICT, NORTH YORKSHIRE, UK, Sheffield Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2J. W89-02740

KAMENITZAS OF GAIT BARROWS NATION-AL NATURE RESERVE, NORTH LANCA-SHIRE, ENGLAND, Lancaster Univ. (England). Dept. of Geography. L. Rose, and P. Vincent. IN: New Directions in Karst. Geo Books, Nor-wich, England. 1986. p 473-496, 19 fig, 5 tab, 16 ref.

Descriptors: *Karst, *Karst hydrology, *Soil ero-sion, *Kamenitzas, *Water chemistry, Gait Bar-rows National Nature Reserve, England, Drainage area, Calcium, Magnesium, Hydrogen ion concentration, Conductivity, Geologic fractures, Calcite, Leakage, Geomorphology, Pools.

Gait Barrows National Nature Reserve has some of the best developed low-altitude limestone pave-ments in the British Isles. A characteristic feature ments in the British Isles. A characteristic feature of these pavements in the presence of both active and fossil kamenitzas. To gain some insight into the karstic processes involved in the development of kamenitzas, a sample of 11 solution pits was chosen for detailed study. Weekly water samples were analyzed for Ca, Mg, pH, and conductivity. Variations in the water chemistry between kamenitzas is attributable to such variables as biological activity and catchment area. The location of kamenitzas appears to be strongly controlled by the presence ty and catchment area. The location of kamenitzas appears to be strongly controlled by the presence of calcite veins, which traverse the pavements. Veins that stand proud on the pavement become grooves within the kamenitza. Dissolution and fracture of the calcite veins within the bases of a kamenitza eventually lead to water leakage and termination of kamenitza development. (See also W89-02728) (Author's abstract)

VALLEY EXCAVATION IN THE YORKSHIRE DALES KARST, Trent Polytechnic, Nottingham (England). A. C. Waltham.

IN: New Directions in Karst. Geo Books, Norwich, England. 1986. p 541-550, 4 fig, 12 ref.

Descriptors: *Karst hydrology, *Erosion, *Caves, *Geomorphology, *Yorkshire Dales, *England,

Drainage area, Uranium radioisotopes, Geology, Graphical analysis, Isotope studies, Karst.

The Yorkshire Dales region is one of spectacular glaciokarst containing extensive cave systems. Uranium series determinations of stalagmite ages allow estimates of the dates of cave passage drainage when contemporary valley floors were at lower levels. Tentative results for three valleys west of Ingleborough suggest a mean rate of valley floor excavation of 0.12 m per 1000 years, and a history of the Dales extending over at least a million years. (See also W89-02728) (Author's abstract) W89-02742

ODOUR CONTROL BY GROUNDWATER RECHARGE, RV ARTIFICIAL.

Linkoeping Univ. (Sweden). Dept. of Water in Environment and Society. For primary bibliographic entry see Field 5F. W89-02799

INFLUENCE OF GROUND WATER ON SOIL-STRUCTURE INTERACTION,

City Univ. of New York.
C. J. Costantino, and A. J. Philippacopoulos.
Available from the National Technical Information
Service, Springfield, VA 22161 as NUREG/CR-4784. Price codes: A04 in paper copy, A01 in microfiche. Report No. NUREG/CR-4784. BNL-NUREG-S2039. 55p. 19 fig, 38 ref. NRC Contract
DE-AC02-76CH00016.

Descriptors: *Soil properties, *Structural behavior, *Soil mechanics, *Groundwater, *Soil water, Computer programs, Mathematical studies, Soil profiles, Pore water, Mathematical equations.

A finite element computer program was used to study the impact of depth on the groundwater surface on the Soil-Structure Interaction (SSI) problem, in this summary of the second year's effort on the subject of the influence of foundation groundwater on SSI phenomenon. The formulation used is based on the Biot dynamic equations of motion for both the solid and fluid phases of a typical soil. Frequency dependent interaction coefficients were then generated for the two-dimensional plane problem of a rigid surface footing moving against a linear soil. The soil is considered dry above the GWT (groundwater table) and fully saturated below. The results indicate that interaction coefficients are significantly modified as comdry above the Un't groundwater table; and tuny saturated below. The results indicate that interaction coefficients are significantly modified as compared to the comparable values for a dry soil, particularly for the rocking mode of response, if the GWT is close to the foundation. As the GWT moves away from the foundation, these effects decrease in a relatively orderly fashion for both the horizontal and rocking modes of response. For the vertical interaction coefficients, the rate of convergence to the dry solution is frequency dependent. Calculations were made to study the impact of the modified interaction coefficients on the response of a typical nuclear reactor building. The amplification factors for a stick model placed atop a dry and saturated soil were computed. It was found that pore water caused the rocking response to decrease, and translational response to increase, over the frequency range of interest, as compared to the response on dry soil. (Author's abstract)

ISOTOPIC INVESTIGATION ON THE EVOLU-TION OF GROUNDWATER DYNAMICS IN THE PRINCIPAL AQUIFERS IN THE SOUTH-ERN DOBRUDJA,

Institutul de Meteorologie si Hidrologie, Bucharest

Available from the National Technical Information Available from the National Technical Information Service, Springfield, VA. 22161, as DE88-700608. Price codes: A06 in paper copy, A01 in microfiche. Report No. IAEA - R - 3621-F, December 1985. 102p, 32 fig, 6 tab, 13 append. IAEA Contract 3621/RB.

Descriptors: *Isotopic tracers, *Tracers, *Ground-water movement, *Groundwater recharge,

Group 2F-Groundwater

*Aquifers, *Romania, Geohydrology, Tectonics, Surface water, Radioisotopes.

Surface water, Radioisotopes.

An environmental isotope technique was applied to the geohydrological study of Southern Dobrudja, a region fully justifying an isotopic study at a regional scale both due to the importance of ground aquifers and to the rate of anthropic changes. In the study of karst-chalky aquifers in the area, more than with other types of aquifers, the isotopic methods proved very useful in specifying certain essential aspects of the hydrodynamic situation and even of quantitative assessments of some geohydrological parameters otherwise impossible to obtain by classical methods of study. One unique aspect clearly brought to the fore is the importance of tectonics in determining the regional hydrodynamic pattern of the Barremian-Jurassic aquifer. The drainage areas, both the one in the north-east of the region and the one in the south-east are conditioned by the existence of two regional fractures: the Capidava-Ovidiu and the Mangalia faults, respectively; the zones with ascending leakage at the Barremian-Jurassic and at the Sarmatian levels are also influenced by tectonics, namely, by the faults delimiting the Tuzlarprasar horst. The Sarmatian waters proved to be recharged mainly from surface waters circulated in the region while the Barremian-Jurassic ones Iopraisar norst. The Sarmatian waters proved to be recharged mainly from surface waters circulat-ed in the region while the Barremian-Jurassic ones are recharged from meteoric waters exclusively and having fallen during the cold season in higher regions situated south from Romania's territory. It was also proved that the extensive hydraulic and land reclamation works in the area were echoed at the level of the Sarmatian aquifer but failed to influence the Barremian-Jurassic which is better influence the barremain-jurassic which is better screened. The radiocarbon analyses proved very useful in defining the groundwater flow model, particularly in the case of the Barremian-jurassic. The processing of these analyses in view of per-The processing of these analyses in view of per-forming corrections with various methods hinted at the fact that, in the case of carbonated aquifers, the methods employed reduce the radiometric age by down to 40%, substantially more than with some porous aquifers of comparable ages. (Lantz-PTT) W89-02853

PIPEFLOW AND PIPE EROSION IN THE MAESNANT EXPERIMENTAL CATCHMENT, University Coll. of Wales, Aberystwyth. Dept. of For primary bibliographic entry see Field 2E. W89-02884

EVALUATION OF BASELINE CONDITIONS AT LEASE TRACT C-A, RIO BLANCO COUNTY, COLORADO, University of Wyoming Research Corp., Laramie. Western Research Inst. For primary bibliographic entry see Field 5B. W89-02974

SUPERFUND RECORD OF DECISION: KA-TONAH MUNICIPAL WELL, NY.

Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response. For primary bibliographic entry see Field 5G. W89-02979

CHARACTERIZATION OF COLLOIDS IN GROUNDWATER,
Technische Univ. Muenchen, Garching (Germany,

F.R.). Lehrstuhl und Inst. fuer Radiochemie. For primary bibliographic entry see Field 2K. W89-02998

CONFIGURATION AND HYDROLOGY OF THE PRE-CRETACEOUS ROCKS UNDERLY-ING THE SOUTHEASTERN COASTAL PLAIN AQUIFER SYSTEM,
Geological Survey, Reston, VA. Water Resources

R. L. Wait, and M. E. Davis.

Available from Books and Open File Report Section, USGS, Box 25425, Denver, CO 80225, USGS Water-Resources Investigations Report 86-4010, 1986. I sheet (map), I fig. I tab, 57 ref.

Descriptors: *Maps, *Aquifers, *Southeastern Coastal Plain Aquifer, *Groundwater movement, *Rock properties, Transmissivity, Porosity, Perme-ability, Geohydrology.

An investigation was conduced to define the configuration and hydrology of the rock surface upon which the sand aquifers and confining beds of the Southeastern Coastal Plain aquifer system were deposited. The base of the Southeastern Coastal Southeastern Coastal rain aquater system were deposited. The base of the Southeastern Coastal Plain aquifer system consists of crystalline rocks, aprolite, Paleozoic rocks, Triassic sedimentary rocks (some of which are intruded by basalt), and Jurassic sedimentary rocks. The permeability of these rocks is extremely low and little exchange of water occurs upward to the overlying Cretaceous aquifers. Porosity values are in the range of 10% or less in some of the rocks, indicating little water is stored in them. The transmissivity values are extremely low, indicating very slow movement of water in these rocks. The small volume of water moving at a very slow rate has a long residence time and is usually mineralized to a greater degree than water in the more permeable overlying sediments. (Peters-PTT) W89-03007

QUALITY OF GROUND WATER IN THE PAYETTE RIVER BASIN, IDAHO, Geological Survey, Boise, ID. Water Resources

For primary bibliographic entry see Field 5G. W89-03008

MATHEMATICAL MODELS FOR INTERPRE-TATION OF TRACER DATA IN GROUND-WATER HYDROLOGY. International Atomic Energy Agency, Vienna

Proceedings of an Advisory Group Meeting on Mathematical Models for Interpretation of Tracer Data in Groundwater Hydrology Organized by

Data in Groundwater Hydrology Organized by the International Atomic Energy Agency and Held in Vienna, 17-21 September 1984. Available from the NTIS, Springfield, VA 22161, as DE87-701515. Price codes: Al1 in paper copy, A01 in microfiche. IAEA-TECDOC-381, 1986. 234p.

*Tracers, *Groundwater movement, *Groundwater, *Data interpretation, *Mathematical models, Isotopic tracers, *Geohydrology, Conferences, Quantitative analysis, Data acquisition, Research

The Advisory Group Meeting noted that the use of different existing and potentially-available approaches and methodologies in the development of models for quantitative evaluations of groundwater tracers are very much governed by various factors such as the type of aquifer systems considered, the size and scale of tracer experiments, the extent and size and scale of tracer experiments, the extent and availability of basic data on relevant hydrological, geological, hydrogeological, and other parameters. Invited review papers and working documents presented were aimed to provide: (1) a thorough review of the existing methodologies that could be practically employed for quantitative interpretation of tracer data for various hydrological probes involved in groundwater survey. (2) desided tion of tracer data for various nydrological prob-lems involved in groundwater systems; (2) detailed appraisal of limitations and data requirements for different possible approaches in development of mathematical models for a tracer case; and (3) basis and framework for further developments and re-search needed in this field. This publication brings together these review and working paters. (See W89-03010 thru W89-03017) (Shidler-PTT)

ROLE OF TRACER METHODS IN HYDROLOGY AS A SOURCE OF PHYSICAL INFORMATION: BASIC CONCEPTS AND DEFINITIONS, TIME RELATIONSHIP IN DYNAMIC SYS-

Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Jacob Blaustein Inst. for Desert Research. For primary bibliographic entry see Field 7B. W89-03010

GENERAL REVIEW OF METHODOLOGIES AND APPROACHES IN MATHEMATICAL

MODELS FOR INTERPRETATION OF TRACER DATA IN HYDROLOGY, Ecole Nationale Superieure des Mines de Paris, Fontainebleau (France). Centre d'Information Geologique. P. Goblet.

IN: Mathematical Models for Interpretation of Tracer Data in Groundwater Hydrology. Interna-tional Atomic Energy Agency, Vienna, Austria. 1986. p 45-68, 27 ref.

Descriptors: *Geohydrology, *Data interpretation, *Mathematical models, *Tracers, *Literature review, *Groundwater movement, *Isotopic tracers, Mass transfer, Simulation, Theoretical analysis.

A general review of the mass-transport mechanisms in saturated groundwater flow and related basic concepts are provided. Topics discussed include description of the medium, transport mechanisms for a conservative element, description of the boundaries, retarding mechanisms, and limits of the dispersion theory. Also treated are available methodologies for the numerical simulation of mass transfer, such as extension of analytical solutions, discretized methods methods of characteristics. mass transter, such as extension of analytical solu-tions, discretized methods, methods of characteris-tics, simulation of retarding phenomena, and appli-cability of the numerical methods of simulation to tracer tests. (See also W89-03009) (Shidler-PTT) W89-03011

REVIEW OF EXISTING MATHEMATICAL MODELS FOR INTERPRETATION OF TRACER DATA IN HYDROLOGY,

Institute of Nuclear Physics, Krakow (Poland).

A. Zuber:

IN: Mathematical Models for Interpretation of Tracer Data in Groundwater Hydrology. International Atomic Energy Agency, Vienna, Austria. 1986. p 69-116, 8 fig. 1 tab, 82 ref.

Descriptors: *Geohydrology, *Data interpretation, *Mathematical models, *Tracers, *Literature review, Isotopic tracers, Mass transfer, Solute transport, Porous media, Fracture permeability, Groundwater movement, Flow velocity, Model testing, Varied flow, Geologic fractures.

Advantages and limitations are reviewed of mathematical models applied to the interpretation of artificial experiments and environmental tracer tests. It concludes that the dispersion equation, coupled, when necessary, with mass-transfer equations, is the best possible model for solving practical problems related to the transport of solutes in both porous and densely-fissured media. The short-comings and limitations of the dispersion equation should be recognized particularly while dealing with scale effects in macrodispersion. A better understanding of the mechanism of macrodispersion may be obtained from stochastic models. When designing a tracer experiment, or interpretwhen designing a tracer experiment, or interpret-ing experimental results, it is important to remem-ber that a conservative tracer does not necessarily ber that a conservative tracer does not necessarily reflect the bulk movement of water directly because an ideal tracer for water molecules does not mean an ideal tracer for the flow (mass transport) of water. The carbon-14 method and other tracer methods do not yield the velocity of water (real age of water) in fissured rocks, because of tracer diffusion into stagnant water in the micropores of the rock matrix. Even though considerable diffusion into stagnant water in the micropores of the rock matrix. Even though considerable progress has been achieved in the development of models for the interpretation of environmental data, a good fit of a mathematical model to the data, a good fit of a mathematical model to the experimental data is a necessary, but not sufficient, condition for regarding the model as valid. The theory of tracer data in variable-flow systems seems to be in the initial stages of development; no experimental evidence exists on the applicability of approaches developed so far, with the exception of the relatively easy-to-apply multi-box approach. (See also W89-03009) (Shidler-PTT)

SOLUTE TRANSPORT IN FRACTURED

Royal Inst. of Tech., Stockholm (Sweden). Dept. of Chemical Engineering. I. Neretnieks.

Groundwater-Group 2F

IN: Mathematical Models for Interpretation of Tracer Data in Groundwater Hydrology. Interna-tional Atomic Energy Agency, Vienna, Austria. 1986. p 139-164, 2 tab, 7 fig, 32 ref.

Descriptors: *Tracers, *Groundwater movement, *Geohydrology, *Solute transport, *Geologic fractures, Fracture permeability, Mathematical models, Aquifers, Channeling, Stagnant water, Tracers, Field tests, Data interpretation.

Many of the mechanisms which influence tracer Many of the mechanisms which influence tracer movement in fissured rock are well-understood in principle. This paper describes the basic physical processes involved. Mathematical models and methodologies used in evaluating tracer experiments in fractured aquifer systems are also reviewed. There are several processes which as yet have not been much studied and which seem to have not been much studied and which seem to play a large and sometimes dominating role. Channeling and matrix diffusion can strongly influence the movement of artificial as well as natural tracers in fissured rock. There are mechanisms which are suspected of taking place (e.g., diffusion into stagnant zones other than the micropores of the matrix) which could have a considerable influence. The large number of processes influencing field experiments make it very difficult to evaluate the parameters describing these processes with any confidence. Independent laboratory measurements or other independent observations would increase the level of confidence in the evaluation of experiments. (See also W89-03009) (Shidler-PTT)

COMPUTER MODELLING OF CONFINED AQUIFER SYSTEMS FOR INTERPRETATION OF CHEMICAL AND ENVIRONMENTAL ISO-

TOPE DATA,
Niedersaechsisches Landesamt fuer Bodenforschung, Hanover (Germany, F.R.)

chung, Hanovel College M. A. Geyh.

IN: Mathematical Models for Interpretation of Tracer Data in Groundwater Hydrology. International Atomic Energy Agency, Vienna, Austria. 1986. p 165-179, 7 fig, 16 ref.

Descriptors: *Groundwater movement, *Tracers, *Data interpretation, *Computer models, *Confined aquifers, Isotope studies, Steady flow, Hydraulic conductivity, Unsteady flow, Geohydro-

A simple numerical solution of the two-dimension-A simple numerical solution of the two-dimensional hydraulic model for steady-state flow in confined aquifer systems is presented. The hydraulic conductivity of the confining bed can be determined with a minimum of field data or analysis of initied with a minimum of neito data of analysis of the chemical and isotopic compositions and with the possibility of quickly adapting the model to the particular field situation. A promising field of theo-retical improvement to the hydraulic model is the implementation of non-steady-state flow to esti-mate needed initial field data from the changes in mate needed initial field data from the changes in chemical and isotopic compositions with time in areas pumped for long periods of time. In addition, it may become possible to derive hydrogeological field parameters from the temporal behavior of the load in the groundwater. (See also W89-03009) (Shidler-PTTT) W89-03015

APPLICATION OF A TRANSPORT-DIFFU-SION MODEL TO A COASTAL AQUIFER UTI-LIZING IN SITU MEASUREMENTS OF DIS-

Instituto di Ricerca sulle Acque, Bari (Italy).
S. Troisi, M. Vurro, and L. Castellano.
IN: Mathematical Models for Interpretation of

Tracer Data in Groundwater Hydrology. International Atomic Energy Agency, Vienna, Austria. 1986. p 181-202, 16 fig, 40 ref.

Descriptors: *Groundwater movement, *Tracers, *Hydrologic models, *Coastal aquifers, *Dispersivity, In situ tests, Porous media, Italy, Natural flow, Pumping tests, Path of pollutants, Ground-

Classical experimental (the 'two-well pulse' method) and theoretical (hydrodispersive scheme)

methodologies commonly used to analyze porous media were applied to the Nardo' Aquifer in south-ern Italy. The results were satisfactory only in the case of natural flow. Recent pumping tests indicat-ed that tracer spreading was highly sensitive to pumping rate. A more thorough analysis is needed to understand the effective characteristics of the transport mechanisms. (See also W89-03009) (Au-thor's abstract)

USE OF LINEAR COMPARTMENTAL SIMULATION APPROACH FOR QUANTITATIVE INTERPRETATION OF ISOTOPE DATA UNDER TIME VARIANT FLOW CONDITIONS, International Atomic Energy Agency, Vienna (Austria). Div. of Research and Labs. For primary bibliographic entry see Field 7C. W89-03017

LAND SUBSIDENCE IN THE SAN JOAQUIN VALLEY, CALIFORNIA, AS OF 1980, For primary bibliographic entry see Field 6G. W89-03018

LAND SUBSIDENCE IN THE SANTA CLARA VALLEY, CALIFORNIA, AS OF 1982, For primary bibliographic entry see Field 6G. W89-03019

RECONNAISSANCE OF THE HYDROTHER-MAL RESOURCES OF UTAH, Geological Survey, Arvada, CO. F. E. Rush.

Available from Superintendent of Documents, Government Printing Office, Washington, DC 20402. USGS Professional Paper 1044-H, 1983. 49p, 28 fig, 18 tab, 56 ref, (Geohydrology of Geo-thermal Systems).

Descriptors: *Hydrothermal studies, *Geothermal resources, *Utah, Geology, Basin and Range province, Rocks, Basalts, Volcanoes, Geothermal power, Hot springs, Exploration, Geologic mapping, Geohydrology.

Geological factors in the Basin and Range province in Utah are more favorable for the occurrence of geothermal resources than in other areas on the Colorado Plateaus or in the Middle Rocky Mountains. These geologic factors are principally crustal extension and crustal thinning during the last 17 million years. Basalts as young as 10,000 years have been mapped in the area. High-silica volcanic and intrusive rocks of Quaternary age can be used to locate hydrothermal convection systems. Drilling for hot, high-silica, buried rock bodies is most promising in the areas of recent volcanic activity. Southwestern Utah has more geothermal potential than other parts of the Basin and Range province in Utah. The Roosevelt Hot Springs area, the Cove Fort-Sulphurdale area, and the area to the north as far as 40 kilometers from them probably have the best potential for geothermal development for generation of electricity. Other areas with estimated reservoir temperatures greater than 150 C are Thermo, Monroe, Red Hill (in the Monroe-Joseph Known Geothermal Resource Area), Joseph Hot Springs, and the Newcastle area. The rates of heat and water discharge are high at Crater, Meadow, and Hatton Hot Springs, but estimated reservoir temperatures there are less than 150 C. Additional exploration is needed to define the potential in three additional areas in the Escalante Desert. (Author's abstract) thor's abstract) W89-03020

GROUNDWATER FLOW SYSTEM IN NORTH-ERN MISSOURI WITH EMPHASIS ON THE CAMBRIAN-ORDOVICIAN AQUIFER, Geological Survey, Rolla, MO. J. L. Imes.

J. L. mes. Available from Books and Open-File Reports Sec-tion, USGS, Box 25425, Denver, CO 80225. USGS Professional Paper 1305, 1985. 61p, 29 fig, 3 tab, 24 ref, 1 plate in pocket.

Descriptors: *Model studies, *Groundwater move-ment, *Aquifers, *Missouri, Alluvial deposits, Gla-

cial drift, Model studies, Saline water systems, Saline water barriers, Illinois, Leakage, Infiltration, Potentiometric level, Model testing, Pumping, Groundwater divide, Saline water intrusion.

rotentiometric level, Model testing, Pumping, Groundwater divide, Saline water intrusion.

The hydrologically important aquifers in northern Missouri are (1) alluvial valley deposits, (2) surficial deposits of glacial drift, (3) the Mississippian aquifer, and (4) the Cambrian-Ordovician aquifer. The Cambrian-Ordovician aquifer was studied in detail. The construction of detailed potentiometric maps and the results of modeling studies of the Cambrian-Ordovician aquifer show that an eight county region immediately north of the Missouri River has a local freshwater flow system independent of the regional saline-water flow system. Potentiometric divides prevent saline water from entering this freshwater area. Part of the saline water discharges in Chariton and southern Howard Counties. The remainder flows eastward into Illinois. In the freshwater region, water enters the Cambrian-Ordovician aquifer by vertical leakage from the overlying Mississippian limestone formation and infiltration of precipitation where the aquifer crops out atop the Lincoln fold. The freshwater discharges along the Missouri and Mississippi Rivers. A two-dimensional model of the Cambrian-Ordovician aquifer in northeastern Missouri was calibrated to prepumping steady-state conditions and to 1965 and May 1979 transient potentiometric surfaces. The model was used to predict effects of future water withdrawals at two potential rates: (1) continued withdrawal at 1980 pumping rates, and (2) accelerated withdrawal, increasing by 1% per yr more than 1980 pumping rates. Under both conditions the potentiometric surface approaches steady state by 1990. The groundwater divides are slowly migrating southward due to present (1983) pumping stresses on the freshwater part of the aquifer and will continue in the future. This will allow saline water to move into former freshwater area at a rate estimated to be 5 to 15 ft per yr by 1990. (Author's abstract)

HYDROGEOCHEMISTRY OF THE UPPER PART OF THE FORT UNION GROUP IN THE GASCOYNE LIGNITE STRIP-MINING AREA, NORTH DAKOTA,

For primary bibliographic entry see Field 4C. W89-03026

SUMMARY OF THE HIGH PLAINS REGION-AL AQUIFER-SYSTEM ANALYSIS IN PARTS OF COLORADO, KANSAS, NEBRASKA, NEW MEXICO, OKLAHOMA, SOUTH DAKOTA, TEXAS, AND WYOMING,

J. B. Weeks, E. D. Gutentag, F. J. Heimes, and R.

Available from Books and Open-File Reports Sec-tion, USGS, Box 25425, Denver, CO 80225. USGS Professional Paper 1400-A, 1988. 30p, 15 fig, 1 tab, 141 ref, (Regional Aquifer-System Analysis).

Descriptors: *Aquifer systems, *Colorado, *Kansas, *Nebraska, *New Mexico, *Oklahoma, *South Dakota, *Texas, *Wyoming, Groundwater storage, Water quality standards, Irrigation, Dis-solved solids, Fluorides, Chlorides, Sulfates, Pumpage, Water table decline, Simulation analysis.

During 1980, 3.25 billion acre-feet of drainable water was stored in the High Plains aquifer. Approximately 65 percent of the water in storage was in Nebraska, and 12 percent was in Texas. New Mexico, the State with the smallest water resource the High Plain and the Plain Plain and the Plain P Mexico, the State with the smallest water resource in the High Plains, had only 1.5 percent of the volume of water in storage. The quality of water in the aquifer generally is suitable for irrigation use but, in many places, the water does not satisfy EPA drinking-water regulations. Excessive concentration of dissolved solids, fluoride, chloride, and sulfate occur in parts of the aquifer in all States. Annual pumpage of ground water for irrigation increased from about 4 million acre-feet during 1949 to nearly 18 million acre-feet during 1949. As of 1980, water levels had declined more than 10 feet in 50,000 square miles and more than 50 feet in 12,000 square miles from predevelopment levels. Water-level declines of as much as 200 feet

Group 2F-Groundwater

had occurred since irrigation started, and the had occurred since irrigation started, and the volume of water in storage in the aquifer had decreased by 166 million acre-feet. Simulation of baseline pumpage from the High Plains aquifer showed that between 1980 and 2020, water-level declines in excess of 100 feet would occur in areas totaling about 15,500 square miles in parts of all States except South Dakota and Wyoming. The maximum 1980-to-2020 water-level decline was projected to be nearly 250 feet in northern Texas. (See also W89-03031) (Author's abstract)

EFFECTS OF FUTURE GROUND-WATER PUMPAGE ON THE HIGH PLAINS AQUIFER IN PARTS OF COLORADO, KANSAS, NEBRASKA, NEW MEXICO, OKLAHOMA, SOUTH DAKOTA, TEXAS, AND WYOMING, Geological Survey, Arvada, CO.
R. R. Luckey, E. D. Gutentag, F. J. Heimes, and J.

R. R. Luckey, L. C. C. R. R. R. Luckey, L. C. C. R. Available from Books and Open-File Reports Section, USGS, Box 25425, Denver, CO 80225, USGS Professional Paper 1400-E, 1988, 44p, 27 fig, 4 tab, 34 ref, (Regional Aquifer-System Analysis).

Descriptors: *Groundwater level, *Water use, *Aquifers, *Pumpage, *Colorado, *Kansas, *Nebraska, *New Mexico, *Oklahoma, *South Dakota, *Texas, *Wyoming, Groundwater management, Computer models, Finite difference methods, Model testing, Future planning, Water management, Water table decline, Management management, planning.

The U.S. Geological Survey conducted a geohydrologic study of the High Plains regional aquifer system to help State and local agencies manage the groundwater resource. Digital, finite-difference models of the groundwater flow system in the southern, central, and northern High Plains were developed during the study. The calibrated models were used to account future, water levels based on developed during the study. The calibrated models were used to project future water levels based on a baseline strategy (continuation of current economic trends and government policies) and on alternatives involving a voluntary reduction in water use (management strategy 1) and a mandatory reduction in water use (management strategy 2). In the southern High Plains, the total simulated pumpage from 1980 to 2020 would be 113 million acre-feet for the baseline strategy 1, and 88 million acre-feet for management strategy 1, and 88 million acre-feet for management strategy 1, and 18 million acre-feet government strategy 2. For the baseline strategy, water levels in the southern High Plains are projected to decline more than 150 feet between tor management strategy 2. For the baseline strategy, water levels in the southern High Plains are projected to decline more than 150 feet between 1980 and 2020 in about 700 square miles. In the central High Plains, simulated pumpage from 1980 to 2020 would be 158 million acre-feet for the baseline strategy, 178 million acre-feet for management strategy 1, and 138 million acre-feet for management strategy 2. For the baseline strategy, water levels in the central High Plains are projected to decline more than 100 feet from 1980 to 2020 in about 3,000 square miles. In the northern High Plains, simulated pumpage from 1980 to 2020 would be 357 million acre-feet for management strategy, 360 million acre-feet for management strategy 1, and 271 million acre-feet for management strategy 2. For the baseline strategy water levels in the northern High Plains are projected to decline more than 100 feet from 1980 to 2020 in about 10,000 square miles. (See also W89-03030) (Author's abstract)

GEOLOGY OF THE FRESH GROUND-WATER BASIN OF THE CENTRAL VALLEY, CALI-FORNIA, WITH TEXTURE MAPS AND SEC-

TIONS, Geological Survey, Pasco, WA. R. W. Page. Available from Books and Open-File Reports Sec-tion, USGS, Box 25425, Denver, CO 80225. USGS Professional Paper 1401-C, 1986. 54p, 35 fig, 2 tab, 173 ref, 5 plates in pocket, (Regional Aquifer-Systems Analysis).

Descriptors: *Groundwater basins, *Geologic mapping, *California, *Geohydrology, *Aquifer characteristics, Groundwater management, Geologic formations, Aquifers, Geomorphology, Rivers, Groundwater movement.

The purpose of this report is to describe the late Cenozoic subsurface geology of the Central Valley. Such knowledge is necessary for proper management of the groundwater resources of the management of the groundwater resources of the valley. Although continental rocks and deposits of Tertiary and Quaternary age compose a number of formations and informal deposits, in total they constitute the major aquifer of the Central Valley. In most places, similarity in sediment type between the continental deposits and some underlying rocks and deposits and even between separate units of constitutional policy and deposits and even between separate units of the continental deposits and some underlying rocks and deposits and even between separate units of continental rocks and deposits makes mapping of subsurface geologic contacts difficult if not practically impossible. Continental rocks and deposits of Tertiary and Quaternary age include (1) the Kern River Formation; (2) the Laguna Formation; (3) the Tulare Formation; (4) the Tehama Formation; and (5) a number of younger formations, as well as some informally named deposits. These deposits and formations also include lacustrine and marsh deposits, which are much thicker and more extensive in the San Joaquin Valley than in the Sacramento Valley. Lacustrine and marsh deposits crop out in the San Joaquin Valley but not in the Sacramento Valley. Continental deposits of Quaternary age crop out chiefly along the major rivers and streams of the valley as well as other low-lying areas; the deposits include river deposits, floodbasin deposits, and sand dunes. The large, asymmetrical, northwestward-trending structural trough of the Central Valley is the principal structure controlling the occurrence and movement of groundwater in the area. (Author's abstract)

REGIONAL AQUIFER SYSTEM UNDERLY-ING THE NORTHERN GREAT PLAINS IN PARTS OF MONTANA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING: SUMMA-

RY, Geological Survey, Arvada, CO. J. S. Downey, and G. A. Dinwiddie. Available from Books and Open-File Reports Sec-tion, USGS, Box 25425, Denver, CO 80225. USGS Professional Paper 1402-A, 1988. 64p, 49 fig, 641 ref, 3 plates in pocket (Regional Aquifer-System Analysis).

Descriptors: *Aquifer systems, *Montana, *North Dakota, *South Dakota, *Wyoming, *Geohydro-logy, Groundwater movement, Sediments, Poten-tiometric level, Groundwater recharge, Water quality control, Mathematical models, Leakage, Pumping.

The Northern Great Plains Regional Aquifer-System Analysis is the first of a series of planned nationwide regional geohydrologic studies. The geologic framework within which the groundwat-er flow system operates has been defined. The study area basically consists of high-land areas of sediment sources and basin areas of sediment deposition. The spatial distribution of hydraulic pres-sure has been portrayed as potentiometric surfaces sure has been portrayed as potentiometric surfaces mapped for several aquifers. The implied ground-water flow system is one of recharge in and near the highland areas in the western and southwestern part of the study area and one of generally eastward and northeastward flow of ground water toward areas of discharge in Canada, North Dakota, and South Dakota. The distribution of chemical quality of the groundwater has been defined with available data, and the mechanisms controlling changes in chemical quality have been fined with available data, and the mechanisms controlling changes in chemical quality have been interpreted. The entire system of groundwater flow has been defined as a conceptual model and has been simulated with a mathematical model. Five major aquifers have been defined and simulated, and the digital model has been used to interpret areas and rates of recharge, areas and rates of discharge, areas and rates of discharge, areas and rates of discharge, areas and rates of the model has been further used to simulate several hypothetical pumping alternatives to determine the cause-and-effect relationship between pumping, drawdown, and assumed conditions. (Author's abstract)

SUMMARY OF THE HYDROLOGY OF THE FLORIDAN AQUIFER SYSTEM IN FLORIDA AND IN PARTS OF GEORGIA, SOUTH CAROLINA, AND ALABAMA,

Geological Survey, St. Simons Island, GA. R. H. Johnston, and P. W. Bush. R. H. Johnston, and P. W. Bush. Available from Books and Open-File Reports Sec-tion, USGS, Box 25425, Denver, CO 80225. USGS Professional Paper 1403-A, 1988. 24p, 7 fig, 3 tab, 79 ref, 4 plates in pocket (Regional Aquifer-Sys-tems Analysis).

Descriptors: *Aquifer systems, *Geohydrology, *Florida, *Georgia, *South Carolina, *Alabama, Water supply, Aquifer characteristics, Carbonate rocks, Permeability, Groundwater movement, Karst hydrology, Springs, Water table decline, Saline water intrusion, Saline-freshwater interfaces, Groundwater potential, Transmissivity, Water quality, Floridan aquifer.

The Floridan aquifer system is one of the major The Floridan aquiter system is one or the major sources of groundwater supplies in the United States. This highly productive aquifer system underlies all of Florida, southern Georgia, and small parts of adjoining Alabama and South Carolina, for a total area of about 100,000 square miles. About 3 a total area of about 100,000 square miles. About 3 billion gallons of water per day is withdrawn from the aquifer for all uses, and, in many areas, the Floridan is the sole source of freshwater. The aquifer system is a sequence of hydraulically connected carbonate rocks that generally range in age from Late Paleocene to Early Miocene. The aquifer system consists of an upper aquifer and a lower aquifer, separated by a less permeable confining unit of highly variable properties. Low-permeability clastic rocks overlie much of the Floridan aquifer system. The Floridan aquifer system derives its permeability from openings that vary from fossil hashes and networks of many solution-widened joints to large cavernous openings in karst ened joints to large cavernous openings in karst areas. The dominant feature of the Floridan flow system, both before and after groundwater devel-opment, is Upper Floridan aquifer springs, nearly all of which occur in unconfined and semiconfined all of which occur in uncontined and semicontined parts of the aquifer in Florida. Three billion gal-lons per day pumped from the Floridan aquifer system has resulted in long-term regional water-level declines of more than 10 ft in three broad areas of the flow system: (1) coastal Georgia and adjacent South Carolina and northeast Florida; (2) west-central Florida; and (3) the Florida panhan-dle. Saltwater has encroached as a result of pumpdle. Saltwater has encroached as a result of pumping in a few coastal areas. In general, the water chemistry in the Upper Floridan is related to flow and proximity to the freshwater-saltwater interface. A considerable area of the Floridan aquifer system's extent remains highly favorable for the development of large groundwater supplies. This area is largely inland and is characterized by high transmissivity and minimal development (as of early 1980's). The major constraint on future development is degradation of water quality rather than water-quantity limitations. (Author's abstract) W89-03034

MIGRATION OF ACIDIC GROUNDWATER SEEPAGE FROM URANIUM-TAILINGS IM-POUNDMENTS: 1, FIELD STUDY AND CON-CEPTUAL HYDROGEOCHEMICAL MODEL. Morwijk Enterprises, Vancouver (British Colum-

bia). For primary bibliographic entry see Field 5B.

MIGRATION OF ACIDIC GROUNDWATER SEEPAGE FROM URANIUM-TAILINGS IM-POUNDMENTS: 2, GEOCHEMICAL BEHAV-IOR OF RADIONUCLIDES IN GROUNDWAT-

Morwijk Enterprises, Vancouver (British Colum-

For primary bibliographic entry see Field 5B. W89-03038

MIGRATION OF ACIDIC GROUNDWATER SEEPAGE FROM URANIUM-TAILINGS IM-POUNDMENTS: 3. SIMULATIONS OF THE CONCEPTUAL MODEL WITH APPLICATION TO SEEPAGE AREA A, MORWIJK Enterprises, Vancouver (British Columbia)

For primary bibliographic entry see Field 5B.

Groundwater-Group 2F

W89_03039

GROUNDWATER FLOW THROUGH A MILIO-LITE LIMESTONE AQUIFER,
Birmingham Univ. (England). Dept. of Civil Engi-

neering. K. R. Rushton, and S. V. Raghava Rao. Hydrological Sciences Journal HSJODN, Vol. 33, No. 5, p 449-464, October 1988. 9 fig, 3 tab, 7 ref.

Descriptors: *Groundwater movement, *Aquifer characteristics, *Artificial recharge, *Coastal aquifers, *Saline water intrusion, India, Agriculture, Transmissivity, Limestone, Geologic fractures, Model studies, Pump wells, Well yield.

A flow study was conducted in a coastal aquifer in western India. Extensive exploitation of this aqui-fer in western Gujarat has resulted in saline intrusion for distances of several kilometers from the coast; as a result of the saline intrusion, agriculture coast; as a result of the saline intrusion, agriculture has largely ceased in the coastal belt. An examination of field information suggested that the transmissivity of the aquifer varies significantly between high and low groundwater heads. Pumping tests indicated that this is due to the development of major fissures in the upper part of the aquifer. A regional groundwater model with varying transmissivities was used to represent the field behavior. Satisfactory agreement was obtained for regional distributions of groundwater head, variations of groundwater head with time, spring flows, and saline inflows. The model was also used to examine the effect of artificial recharge on the alleviation of saline-intrusion problems in the coastal area. It was found that artificial recharge would have a minimal effect on the conditions in the coastal zone but would improve the yield of the pumped wells in mai effect of the conditions in the coastal zone but would improve the yield of the pumped wells in the vicinity of the recharge site; less than 5% of the recharged water would be lost to springs or to the sea provided that the abstraction continues at the present rate. (Shidler-PTT) W89-03050

GROUNDWATER OCCURRENCE AND FLOW PATTERN IN THE ENUGU COAL-MINE AREA, ANAMBRA STATE, NIGERIA,

AREA, ANAMBRA STATE, NIGERIA, Federal Univ. of Technology, Owerri (Nigeria). School of Natural and Applied Sciences. G. I. Nwankwor, B. C. Egboka, and I. P. Orajaka. Hydrological Sciences Journal HSJODN, Vol. 33, No. 5, p

Descriptors: *Groundwater movement, *Flow pat-tern, *Coal mines, *Nigeria, Geologic units, Groundwater level, Seepage, Aquifer systems, Aquitards, Flow velocity, Hydraulic conductivity,

The distribution of major geological units, static The distribution of major geological units, static water-level data, water-chemistry data, and observations of surface features influenced by ground-water seepage were used to characterize ground-water behavior. Considerations of geology, groundwater levels, and seepage in the mines indicate that the coal sequence is a multiaquifer system in which sandstone and local coal aquifers alternate with shale aquitards. Based on the hydraulic head data, the groundwater flow is predominantly downwards. Groundwater velocity calculation across the multiaquifer system using the Darcy equation gave a flow velocity of 1 m/day. For groundwater systems, such a calculated velocity is equation gave a flow velocity of 1 m/day. For groundwater systems, such a calculated velocity is considered high. The high velocity is most probably due to the high fracture porosity as well as the presence of other stratigraphic and structural features such as alluvial fills that provide high bydraulic conductivity nathways across the aquifer hydraulic conductivity pathways across the aquifer system. The pattern of groundwater inflow into the mines is also influenced by these stratigraphic and structural features. (Author's abstract) W89-03051

IDENTIFICATION OF A KARST HYDROLOGICAL SYSTEM IN THE DINARIC KARST (YUGOSLAVIA), Split Univ. (Yugoslavia). Faculty of Civil Engi-

neering Sciences.

O. Bonacci, and J. Jelin.

Hydrological Sciences Journal HSJODN, Vol. 33,

No. 5, p 483-497, October 1988. 11 fig. 14 ref.

Descriptors: *Groundwater, *Karst hydrology, *Hydrologic systems, *Yugoslavia, Reservoirs, Springs, Intermittent springs, Flow discharge, Water loss, Leakage, Hydrograph analysis, Recession curve, Discharge measurement, Retention ca-

The construction of a reservoir on the Neretva River resulted in the flooding of three springs which now function as ponors (swallow-holes). At first, they discharged 28 cubic m/s of water from the full reservoir. Reclamation works were planned to reduce the losses from the reservoir. Attempts to seal the leaks resulted only in reducing the loss to 22 cu m/s. All the water that is lost through these ponors appears some 1 km downstream from the dam in a group of springs. Most of these springs were, before the dam's construction, only temporary; during the dry period their discharge was approximately 1 cu m/s. In order to identify the karst system, the position and dimensions of the karst channels through which the greatest quantities of water are lost from the reservoir were determined by definition of the hydrograph recession curves and discharge curves of downstream springs. The recession part of the hydrograph was defined by applying a new expression of the Maillet formula. Thus, it became possible to define not only the transport characteristics of the karst mass but also its retention characteristics. When the karst system is defined, it will be possible to carry out reclamation more efficiently and with lower costs. (Author's abstract)

GROUNDWATER MICROBIOLOGY: PROB-LEMS AND BIOLOGICAL TREATMENT: STATE-OF-THE-ART REPORT, Vizgazdalkodasi Tudomanyos Kutato Intezet, Bu-

dapest (Hu L. Alfoldi. st (Hungary).

Water Science and Technology WSTED4, Vol. 20, No. 3, p 1-31, 1988. 16 fig, 4 tab, 108 ref.

Descriptors: *Pathogenic bacteria, *Groundwater, *Microorganisms, *Groundwater pollution, *Bio-degradation, *Microbial degradation, Wastewater, Bacteria, Viruses, Protozoa, Yeasts.

The quality of groundwater depends greatly on the microbial activity in the soil above the groundwater table and in the aquifer itself. Current knowledge on the ecology of groundwater microbes, including pathogenic viruses, bacteria, yeasts, and protozoa is summarized. Particular emphasis is placed upon the role of microorganisms in the biodegradation of groundwater pollutants. (Sand-TTD. PTT) W89-03075

ATMOSPHERIC. GEOLOGICAL. AND ANTHROPOGENIC EFFECTS GROUNDWATER QUALITY IN FINLAND, Geologian Tutkimuskeskus, Espoo (Finland). Dept. of Geochemistry. For primary bibliographic entry see Field 5B. W89-03076

VULNERABILITY STUDY OF THE AUBER-GENVILLE AQUIFER, Lyonnaise des Eaux, Paris (France). For primary bibliographic entry see Field 5B. W89-03077

MICROBIAL ACTIVITY IN SANITARY LAND-FILLS: A POSSIBLE SOURCE OF THE HUMIC SUBSTANCES IN GROUNDWATER,

Bundesgeamdheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene. For primary bibliographic entry see Field 5B. W89-03079

MOVEMENT AND SURVIVAL OF BACTERIA IN POROUS MEDIA, Technion - Israel Inst. of Tech., Haifa. Sherman Center for Research in Environmental and Water

Resources Engineering. For primary bibliographic entry see Field 5B. W89-03080

BIOLOGICAL DEGRADATION OF VOLATILE CHLORINATED HYDROCARBONS IN CHLORINATED GROUNDWATER.

Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene. For primary bibliographic entry see Field 5B. W89-03081

AQUIFER THERMAL ENERGY STORAGE IN

Vesi-Hydro, Helsinki (Finland). For primary bibliographic entry see Field 4B. W89-03082

APPLICATION OF ENVIRONMENTAL RISK ANALYSIS TO GROUNDWATER PROTEC-TION,

IION, Insincori- ja Limnologitoimisto Oy Vesitekniikka A.B., Salpakangas (Finland). For primary bibliographic entry see Field 5G. W89-03083

GROUND WATER: A LIVING ECOSYSTEM, Helsinki Univ. (Finland). Dept. of Limnology. H. Seppanen.

Water Science and Technology WSTED4, Vol. 20, No. 3, p 95-100, 1988. 2 fig, 5 ref.

Descriptors: *Microorganisms, *Groundwater, *Bacteria, *Ecosystems, *Groundwater quality, Iron, Manganese, Organic compounds, Decomposing organic matter, Hydrogen ion concentration.

Many living organisms affect the quality of groundwater. Precipitation and/or solubility of many inorganic compounds depends in some way or other on the biological activity of living organisms. The role of bacteria and other organisms in these processes may be either direct or indirect. The oxygen consumption as a result of the decomposition of organic compounds is one of the money of the processity of organic compounds is one of the money of the processity of organic compounds is one of the money of the processity of organic compounds is one of the money of the processity of organic compounds is one of the money of the processity of organic compounds is one of the money of the processity of organic compounds is one of the money of the processity of organic compounds is one of the processity of organic compounds in our of the processity of organic compounds is one of the processity of organic control or organic position of organic compounds is one of the most important processes affecting the quality of the groundwater. In anoxic environments both iron groundwater. In anoxic environments both iron and manganese are reduced, becoming soluble in the groundwater. In weakly buffered groundwater the release of carbon dioxide during decomposition of organic substances decreases the pH of the water, promoting the solubility of iron and manganese. Most of the bacteria living in the groundwater are psychrophilic and are attached to soil particles. Only a few types of bacteria are free living. (Author's abstract) W89-03084

BIOCHEMICAL TESTING OF GROUNDWAT-

Stadtwerke Mainz A.G. (Germany, F.R.) For primary bibliographic entry see Field 5A. W89-03085

POTENTIAL OF FREE-LIVING GROUND WATER BACTERIA TO DEGRADE AROMAT-IC HYDROCARBONS AND HETEROCYCLIC

Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.

For primary bibliographic entry see Field 5B. W89-03086

EFFECT OF UNSATURATED/SATURATED ZONE PROPERTY UPON THE HYDROGEO-CHEMICAL AND MICROBIOLOGICAL PROC-ESSES INVOLVED IN THE MIGRATION AND ATTENUATION OF LANDFILL LEACHATE COMPONENTS,

Water Research Centre, Medmenham (England). For primary bibliographic entry see Field 5B. W89-03087

Group 2F-Groundwater

UTILIZATION OF BIOLOGICAL METHODS IN GROUNDWATER TREATMENT, Kuopio Water District Office (Finland). For primary bibliographic entry see Field 5F. W89-03088

CLOGGING PROBLEMS IN GROUNDWATER HEAT PUMP SYSTEMS IN SWEDEN, Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Geology.
A. Lindblad-Passe.
Water Science and Technology WSTED4, Vol. 20, No. 3, p 133-140, 1988. 7 fig. 1 tab, 12 ref.

Descriptors: *Groundwater, *Sweden, *Heat pumps, *Clogging, Iron bacteria, Sulfur bacteria, Wells, Pumps, Pipes, Corrosion, Design criteria.

A number of groundwater heat pump systems were investigated to determine the extent of problems caused by the chemistry of the groundwater used. The main purpose was to investigate sites used. The main purpose was to investigate sites using iron-rich groundwater. Fifteen facilities were studied regularly for 3 years. Ten of these facilities had some kind of problem caused by iron precipitation. Four of the sites were rebuilt because of severe plugging due to iron sludge in wells, pumps and pipes. In all facilities with severe problems, iron bacteria were found. Low redox potential, indicated by hydrogen sulfide in the groundwater, seems to protect from iron bacteria. In some of the systems using groundwater with hydrogen sulfide the problems were corrosion and sludge formation the problems were corrosion and sludge formation caused by sulfur oxidizing bacteria. Rapid clogging was caused by aeration of the groundwater due to improper design of the system. Knowledge of the water composition, design of the systems to minimize aeration, and control of clogging turned out to be important factors to maintain operation safety. (Author's abstract) W89-03089

TREATMENT OF GROUNDWATER WITH SLOW SAND FILTRATION, National Board of Waters, Helsinki (Finland). For primary bibliographic entry see Field 5F. W89-03090

VYREDOX AND NITREDOX METHODS OF IN SITU TREATMENT OF GROUNDWATER, Technicn - Israel Inst. of Tech., Haifa. For primary bibliographic entry see Field 5F. W89-03091

MODELLING OF FLOW AND TRANSPORT PROCESSES IN VYREDOX AND NITREDOX SUBSURFACE TREATMENT PLANTS, Technion - Israel Inst. of Tech., Haifa. For primary bibliographic entry see Field 5F. W89-03092

BIOTECHNOLOGY FOR MANGANESE RE-MOVAL FROM GROUNDWATER, Research and Design Inst. of Public Works and Utilities, Sofia (Bulgaria). For primary bibliographic entry see Field 5F. W89-03093

BIOLOGICAL TREATMENT OF GROUND-WATER IN BASINS WITH FLOATING FIL-TERS: I. TEST ARRANGEMENTS AND GEN-

ERAL RESULTS, Kuopio Water District Office (Finland). For primary bibliographic entry see Field 5F. W89-03094

BIOLOGICAL TREATMENT OF GROUND-WATER IN BASINS WITH FLOATING FIL-TERS: II. THE ROLE OF MICROORGANISMS IN FLOATING FILTERS, Helsinki Univ. (Finland). Dept. of Limnology. For primary bibliographic entry see Field 5G. W89-

BIOLOGICAL GROUNDWATER DENITRIFI-CATION: LABORATORY STUDIES,

Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Jacob Blaustein Inst. for Desert Research. For primary bibliographic entry see Field 5F.

IN SITU BIOLOGICAL GROUNDWATER DEN-ITRIFICATION: CONCEPTS AND PRELIMI-

TABLE TESTS,
Tabal Consulting Engineers Ltd., Tel-Aviv (Israel). Water Resources and Environmental Engineering Div.
For primary bibliographic entry see Field 5G.
W89-03097

PROBLEMS IN CZECHOSLOVAKIA REGARD-ING METHODS OF REMOVAL OF NITRATES FROM DRINKING WATER, Ministry of Forestry and Water Conservancy, Prague (Czechoslovakia). For primary bibliographic entry see Field 5D. W89-03098

SEISMIC REFRACTION TESTS ABOVE WATER TABLE,

Institut de Mecanique de Grenoble, Saint-Martin d'Heres (France). For primary bibliographic entry see Field 7A. W89-03113

CONTAMINATED AQUIFERS ARE A FOR-GOTTEN COMPONENT OF THE GLOBAL N2O BUDGET, Weizmann Inst. of Science, Rehovoth (Israel).

Dept. of Isotope Research.
For primary bibliographic entry see Field 5B.
W89-03121

GROUNDWATER CONTAMINATION AT A LANDFILL SITED ON FRACTURED CARBONATE AND SHALE, Waterloo Univ. (Ontario). Inst. for Ground Water

Research. For primary bibliographic entry see Field 5B. W89-03146

GROUNDWATER CONTAMINATION BY NITRATES AND CHLORIDES WASHED OUT FROM PHOSPHORITE ORES IN THE NEGEV DESERT, ISRAEL,

Ministry of Agriculture, Jerusalem (Israel). Hydrological Service. For primary bibliographic entry see Field 5B. W89-03147

SIMULATIONS OF PHYSICAL NONEQUILI-BRIUM SOLUTE TRANSPORT MODELS: AP-PLICATION TO A LARGE-SCALE FIELD EX-PERIMENT.

Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.
M. N. Goltz, and P. V. Roberts.

Journal of Contaminant Hydrology, Vol. 3, No. 1, p 37-63, September 1988, 15 fig. 3 tab, 27 ref. US EPA Robert S. Kerr Environmental Research Laboratory Agreement CR 808051.

Descriptors: *Groundwater, *Path of pollutants, *Solute transport, *Simulation, *Model studies, *Field tests, Mathematical equations, Mathematical models, Hydraulic gradient, Diffusion, Aquifers.

Equations expressing the spatial moments of solute-concentration distributions simulated by various models, in terms of model parameters, various models, in terms or model parameters, have recently been demonstrated. Using independently-obtained parameter values, these equations were used to compare simulations of physical non-equilibrium models with spatial-moment data collected in a large-scale natural gradient experiment on solute transport. The physical nonequilibrium models examined postulate the existence of layered zones of immobile water through which solute is transported by a diffusion mechanism. It was found that the qualitative aspects of the measured moment behavior were simulated by the physical nonequilibrium models if the independently-obtained parameters were modified somewhat on the basis of reasonable corrective assumptions. It was further demonstrated that the physical nonequilibrium models, using parameter values obtained from spatial data, could qualitatively simulate tem-poral behavior at individual well points in this relatively homogeneous aquifer. (Author's abstract) W89-03148

BIODEGRADATION OF NITROGEN- AND OXYGEN-CONTAINING AROMATIC COMPOUNDS IN GROUNDWATER FROM AN OIL-CONTAMINATED AQUIFER,
Technical Univ. of Denmark, Lyngby. Dept. of

Sanitary Engineering.
For primary bibliographic entry see Field 5B. W89-03149

LAGRANGIAN-EULERIAN APPROACH TO MODELING HYDROGEOCHEMICAL TRANSPORT OF MULTI-COMPONENT SYSTEMS, Oak Ridge National Lab., TN. Environmental Sciences Div. For primary bibliographic entry see Field 5B. W89-03320

MODELING GROUNDWATER TRANSPORT OF DISSOLVED GASOLINE AND USING THE RESULTS TO EVALUATE AQUIFER RESTO-RATION PROCESSES, Argonne National Lab., IL. Energy and Environ-mental Systems Div.

For primary bibliographic entry see Field 5B. W89-03321

RATIONALE FOR THE DESIGN OF MONI-TORING WELL SCREENS AND FILTER

Battelle Pacific Northwest Labs., Richland, WA. For primary bibliographic entry see Field 5B. W89-03332

2G. Water In Soils

AIR POLLUTION AND SOIL ACIDIFICATION, Norsk Inst. for Skogforskning, Aas For primary bibliographic entry see Field 5B. W89-02306

DISCUSSION OF THE CHANGES IN SOIL ACIDITY DUE TO NATURAL PROCESSES AND ACID DEPOSITION,

Oak Ridge National Lab., TN. Environmental Sci-For primary bibliographic entry see Field 5B.

SOIL ACIDIFICATION AND METAL SOLU-BILITY IN FORESTS OF SOUTHERN SWEDEN, Lund 1

Lund Univ. (Sweden). Metal Ecology Group. For primary bibliographic entry see Field 5B. W89-02308

DIFFERENCES IN ALUMINUM MOBILIZA-DIFFERENCES IN ALUMINUM MOBILIZA-TION IN SPODOSOLS IN NEW HAMPSHIRE (USA) AND IN THE NETHERLANDS AS A RESULT OF ACID DEPOSITION, Agricultural Univ., Wageningen (Netherlands). Dept. of Soil Science and Geology. For primary bibliographic entry see Field 5B. W89-02309

LIMITS ON CATION LEACHING OF WEAKLY PODZOLIZED FOREST SOILS: AN EMPIRICAL EVALUATION,

Great Lakes Forestry Research Centre, Sault Sainte Marie (Ontario). For primary bibliographic entry see Field 5B. W89-02310

Water In Soils—Group 2G

NATURAL AND ANTHROPOGENIC ACIDIFI-CATION OF PEATLANDS, Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology. For primary bibliographic entry see Field 5B. W89-02311

SOURCES OF ALKALINITY IN PRECAM-BRIAN SHIELD WATERSHEDS UNDER NAT-URAL CONDITIONS AND AFTER FIRE OR

URAL CONDITIONS AND AFTER FIRE OR ACIDIFICATION, Manitoba Univ., Winnipeg. Dept. of Botany. S. W. Bayley, and D. W. Schindler. IN: Effects of Atmospheric Pollutants on Forests, Wetlands, and Agricultural Ecosystems. Springer-Verlag, New York. 1987. p 531-548, 7 fig. 8 tab, 37

Descriptors: *Acidification, *Alkalinity, *Lakes, *Chemistry of precipitation, Wetlands, Chemical properties, Hydrogen ion concentration, Sulfuric acid, Nitric acid, Sulfates, Nitrates, Catchments.

Analysis of 13 years of chemical and hydrological records for three small watersheds in the Experimental Lakes Areas of Northwestern Ontario-yielded the following conclusions: (1) The watersheds did not export significant alkalinity even though precipitation in the area has not been strongly acidic (long-term average = pH 4.9). Rates of alkalinity production in the terrestrial watersheds were a small fraction of those in lakes (2) forest fires did not cause an increase in the alkalinity yield of terrestrial watersheds. Instead, there was a slight tendency for alkalinity to dealkalinity yield of terrestrial watersheds. Instead, there was a slight tendency for alkalinity to decrease following fire due to higher releases of strong acid anions. This might have been due to drought rather than to fire per se; (3) two years of experimental application of sulfuric and nitric acids to a small wetland at roughly 10 times normal rates deposited from the atmosphere caused little change in the acidity of outflow from the wetland. Sulfate and nitrate ions were almost completely retained; and (4) in upland catchments with shallow soils, biological retention of sulfate, nitrate, and ammonimum affected the alkalinity balance more than ion exchange and geochemical weathering. (See also W89-02304) (Author's abstract) W89-02313

RECOGNIZING PETROLEUM HYDROCAR-BON CONTAMINATION IN THE VADOSE ZONE WITH PHOTOIONIZATION DETEC-TION SCANNING OF FIELD SAMPLES,

Firnie (Malcolm), Inc., Phoenix, AZ.
For primary bibliographic entry see Field 5A.
W89-02351

APPLYING ELECTRICAL RESISTANCE BLOCKS FOR UNSATURATED ZONE MONI-TORING AT ARID SITES, EMCON Associates, San Jose, CA. For primary bibliographic entry see Field 7B. W89-02352

MODELING OF POLYCHLORINATED BI-PHENYLS IN VADOSE ZONE, Weston (Roy F.), Inc., West Chester, PA. For primary bibliographic entry see Field 5B. W89-02353

PREDICTING CHEMICAL MOVEMENT IN SOILS, New Mexico State Univ., Las Cruces. Dept. of

Crop and Soil Sciences.
For primary bibliographic entry see Field 5B.
W89-02473

GROUNDWATER PROTECTION BY ACCEL-ERATED TESTING OF ORGANIC CHEMICAL BREAKTHROUGHS OF SOIL BARRIERS, Connecticut Univ., Storrs. Dept. of Chemistry. For primary bibliographic entry see Field 5A. W89-02585

QUANTITATIVE STUDIES OF BIODEGRADA-TION OF PETROLEUM AND SOME MODEL

HYDROCARBONS IN GROUND WATER AND SEDIMENT ENVIRONMENTS, Bemidji State Univ., MN. Center for Environmen-

For primary bibliographic entry see Field 5B. W89-02674

INTERACTIVE SIMULATION OF CHEMICAL MOVEMENT IN SOIL, Oklahoma State Univ., Stillwater. Dept. of Agron-

omy.
For primary bibliographic entry see Field 5B.
W89-02675

INFLUENCE OF GROUND WATER ON SOIL-

STRUCTURE INTERACTION, City Univ. of New York. For primary bibliographic entry see Field 2F. W89-02850

SPATIAL VARIABILITY OF SOIL HYDRODYNAMIC PROPERTIES IN THE PETITE FECHT
CATCHMENT, SOULTZEREN, FRANCE - PRELIMINARY RESULTS,
Strasbourg-I Univ. (France). Inst. de Geographie.
B. Ambroise, Y. Amiet, and J. Mercier.
IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p
35-53, 7 fig., 4 tab, 24 ref. Le Ministre de l'Environnement Convention no. 77-124 and Le Centre National de la Recherche Scientifique ASP PIREN
no. 2180.

Descriptors: *France, *Soil dynamics, *Rainfall-runoff relationships, *Catchment areas, *Soil water, *Fluvial geomorphology, Runoff, Erosion, Statistical analysis, Watersheds, Hydrologic sys-

The necessity of having a good knowledge of the spatial heterogeneity of soil hydrodynamic properties is demonstrated. A sampling method is suggested whereby 'genetically homogeneous' units gested whereby genetically follogicated using geomorphologic and pedalogic maps. A mathematical model is presented which calculates a relative hydraulic conductivity curve based on the soil water retention curve. Good oased on the soil water retention curve. Good agreement was obtained between model results and field determination. The use of retention curves as a basis for the prediction of hydraulic conductivity greatly reduces the amount of soil sampling and analysis required. It is concluded that the experianalysis required. It is concluded that the experimental procedures described (soil mapping, core sampling, laboratory determination of retention curves, curve fitting, conductivity estimation, field controls, statistical analysis) provide an efficient and simple tool for assessing the spatial variability of the soil water properties, and thereby the hydrologic structure and behavior of a watershed. (See also W89-02880) (Miller-PTT)

RAPID SUBSURFACE FLOW AND STREAM-FLOW SOLUTE LOSSES IN A MIXED EVER-GREEN FOREST, NEW ZEALAND, Ministry of Works and Development, Christ-church (New Zealand). M. P. Mosley, and L. K. Rowe. IN: Catchment Experiments in Fluvial Geomor-phology. Geo Books, Norwich, England. 1984. p 169-181, 5 fig, 2 tab, 22 ref.

Descriptors: *Forest hydrology, *Storm seepage, *Solute transport, *New Zealand, *Rainfall-runoff relationships, *Streams, *Runoff, Erosion, Forests, Flow, Sedimentation, Sediment transport, Fluvial geomorphology, Slopes, Bank erosion, Streamflow, Slopes, Bank erosion.

Measurements of subsurface flow during rain storms and under controlled experimental condi-tions indicate that there is rapid movement of tions indicate that there is rapid movement of water along preferred pathways or macropores at rates up to 2 cm/s and that average subsurface flow velocities are about 0.25 to 0.3 cm/s. Streamflow in the study area is generated largely by subsurface flow, both during storm period and baseflow conditions. Solute concentrations in streamflow (which is considered to have chemical

characteristics similar to those of subsurface flow) are about 11 mg/l and in precipitation are about 4.5 mg/l; there is a net loss of solutes of about 60 kg/ha/year. In contrast, net losses of suspended and bed load sediment are on the order of 750 to and bed load sediment are on the order of 750 to 1000 kg/ha/year. It is suggested that the hydrological importance of rapid subsurface flow is responsible for this contrast, in that the rapidity of slope runoff: (1) causes the low concentration of solutes and (2) by generating large streamflow peaks, promotes bank erosion and transport of sediment by the streams. (See also W89-02880) (Author's abstract)

W89-02890

HYDROLOGY AND SOLUTE UPTAKE IN HILLSLOPE SOILS ON MAGNESIAN LIMESTONE: THE WHITWELL WOOD PROJECT, Sheffield Univ. (England). Dept. of Geography. S. T. Trudgill, R. W. Crabtree, A. M. Pickles, K. R. J. Smettem, and T. P. Burt.

IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 183-215, 20 fig, 6 tab, 48 ref. Natural Environment Research Council grant GR3/3459.

Descriptors: *Solute *Soil water, *Soil chemistry, *Weathering, *Forest hydrology, *Limestone, *Forest soils, *Erosion, Geomorphology, Runoff, Hydrology, Soils, Flow, Fluvial geomorphology,

The hydrological and solutional processes for a wooded hillslope on Magnesian Limestone are de-scribed. The routeways and travel times of soil water flow are described in relation to precipita-tion inputs and the influence of soil structure. The water flow are described in relation to precipita-tion inputs and the influence of soil structure. The original hypothesis that any spatial variation in solutional denudation results from spatial variation in hillslope runoff is rejected. Spatial variations in solute uptake and solutional denudation over the solute uptake and solutional denudation over the slope do exist, but were due to spatial variation in soil chemistry and not because of spatial variation in hydrological processes. The results from this study show that soil chemistry, in particular soil pH, may determine the pattern of solutional denu-dation over a landscape. A simple generalized chemistry can be proposed. Under acid soil condi-tions, limited solute uptake and neutralization of acidic water will occur in the soil-bedrock inter-form However, bear sinch alkaliar cells soil water. actions while with occur in the soil-bearcock inter-face. However, base rich alkaline soils, acid water neutralization will occur within the soil and result in soil solute loss, to bedrock lowering. (See also W39-02880) (Miller-PTT) W89-02891

DYNAMICS OF WATER CHEMISTRY IN HARDWOOD AND PINE ECOSYSTEMS, Southeastern Forest Experiment Station, Asheville, NC. Coweeta Hydrologic Lab. For primary bibliographic entry see Field 2K.

VARIABLE SOLUTE SOURCES AND HYDRO-LOGICAL PATHWAYS IN A COASTAL SUB-ALPINE ENVIRONMENT,

For primary bibliographic entry see Field 2K. W89-02901

W89-02900

RELATIONSHIP BETWEEN SOIL CREEP RATE AND CERTAIN CONTROLLING VARIA-BLES IN A CATCHMENT IN UPPER WEAR-DALE, NORTHERN ENGLAND, Durham Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2J.

PATTERNS OF HILLSLOPE SOLUTIONAL DENUDATION IN RELATION TO THE SPATIAL DISTRIBUTION OF SOIL MOISTURE AND SOIL CHEMISTRY OVER A HILLSLOPE HOLLOW AND SPUR,

Huddersfield Polytechnic (England). Dept. of Geography. For primary bibliographic entry see Field 2J. W89-02906

Group 2G-Water In Soils

ROLE OF TRACER DATA FOR MODELING SOIL-WATER FLOW IN THE UNSATURATED ZONE,

Heidelberg Univ. (Germany, F.R.). Inst. fuer Umweltphysik. C. Sonntag.

C. Sonntag.

IN: Mathematical Models for Interpretation of Tracer Data in Groundwater Hydrology. International Atomic Energy Agency, Vienna, Austria. 1986. p 117-137, 9 fig. 18 ref.

Descriptors: *Tracers, *Soil water, *Model studies, *Unsaturated flow, *Aeration zone, *Tracers, Lysimeters, Field tests, Groundwater movement.

The basic formalisms and concepts involved in soil-moisture flow in the unsaturated zone are reviewed and the potential contribution of tracer studies for this purpose are discussed. After an introduction to the general subject, the elements of soil-moisture flow, moisture movement measured by isotope tagging, and moisture movement from environmental isotope data as measured by both lysimeter and field studies are considered in detail. (See also W89-03009) (Shidler-PTT)

INTERACTIONS OF ORGANIC MATTER AND ALUMINUM IONS IN ACID FOREST SOIL SOLUTIONS: METAL COMPLEXATION, FLOCCULATION, AND PRECIPITATION, Goettingen Univ. (Germany, F.R.). Inst. fuer Bodenkunde und Waldernachrung. For primary bibliographic entry see Field 2K. W89-03126

RESPONSES OF FOUR IRISH WETLAND TREE SPECIES TO RAISED SOIL WATER LEVELS

LEVELS, Trinity Coll., Dublin (Ireland). School of Botany. For primary bibliographic entry see Field 2H. W89-03128

SENSITIVITY ANALYSIS OF ADSORPTION AND DEGRADATION PARAMETERS IN THE MODELING OF PESTICIDE TRANSPORT IN SOILS.

SOILS, Institut National de la Recherche Scientifique, Sainte-Foy (Quebec). J.-P. Villeneuve, P. Lafrance, O. Banton, P. Frechette, and C. Robert. Journal of Contaminant Hydrology, Vol. 3, No. 1, p 77-96, September 1988. 7 fig, 5 tab, 31 ref.

Descriptors: *Soil contamination, *Path of pollut-ants, *Pesticides, *Solute transport, *Model stud-ies, *Fate of pollution, *Adsorption, *Degradation, Sensitivity analysis, Aeration zone, Prediction, Carbamate pesticides, Soil profiles, Simulation, Leaching, Root zone, Field tests.

The increasing use of deterministic models in predicting the movement of pesticides in soils, has focused attention on the evaluation of major parameters which represent attenuation factors of organics in the subsurface. These parameters are the degradation-rate constant and the adsorption constant for the pesticide. In view of the large institu variability of these parameters and of the difficulty in obtaining accurate field data there is a high degree of uncertainty associated with the results. culty in obtaining accurate field data there is a high degree of uncertainty associated with the results obtained from deterministic models. A sensitivity analysis was performed to quantify the impact of such variation in each of these input parameters on the output results of an unsaturated-zone transport model. Results showed that variations in these parameters about their respective mean values greatly affected the predicted concentration distributions, obtained after three years, of the pesticide aldicarb in the whole soil profile. A 15-22% variation in the degradation constant, led to a 100% uncertainty in the various simulation results democratianty in the various simulation results deuncertainty in the various simulation results de-fined as the cumulative quantity of aldicarb or the dissolved aldicarb concentration leached below the root zone (or the unsaturated zone) of the soil. Such a deterministic model presents a high degree of sensitivity to these input parameters. Accurate field data are needed to obtain reliable model results in predicting pesticide movement in the un-saturated zone. (Author's abstract)

W89-03150

SOLUTE TRANSPORT MODELING IN HET-EROGENEOUS SOILS: CONJUNCTIVE AP-PLICATION OF PHYSICALLY BASED AND SYSTEM APPROACHES, Hawaii Univ. at Manoa, Honolulu. Dept. of Civil

Journal of Contaminant Hydrology, Vol. 3, No. 1, p 97-111, September 1988. 7 fig, 1 tab, 22 ref.

Descriptors: *Soil contamination, *Path of pollutants, *Solute transport, *Model studies, Mathematical models, Mathematical studies, Linear programming, Nonlinear programming, Chlorides, Convection.

Mathematical models can be formulated by follow-Mathematical models can be formulated by follow-ing physically-based or system approaches. In this study, models based on these approaches were developed to simulate chloride transport in field soils. Given a common data base, concentration profiles calculated by these models showed a rather close similarity and agreement with meas-ured profile. The convention was of these models ured profiles. The conjunctive use of these model-ing approaches indicated that the dispersion coefficient in the physically-based convection-dispersion model was not a constant; instead, it changed with the longitudinal travel distance. As a result, when these models were used to predict solute transport into deeper soil, the physically-based model with a constant dispersion coefficient tended to underesti-mate solute spreading. This was not a problem with a linear system model whose impulse-re-sponse function excluded an explicit dispersion term. (Author's abstract) W89-03151

BIOLOGICAL TRANSFORMATION AND DETOXIFICATION OF 7,12-DIMETHYLBENZ(A)ANTHRACENE IN SOIL

SYSTEMS, Utah State Univ., Logan. For primary bibliographic entry see Field 5B. W89-03161

CHARACTERISTICS OF THE SORPTION OF CHLOROTHALONIL AND AZINPHOS-METHYL TO A SOIL FROM A COMMERCIAL CRANBERRY BOG, Cook Coll., New Brunswick, NJ. Dept. of Envi-ronmental Science.

For primary bibliographic entry see Field 5B. W89-03195

MOVEMENT OF CARBOFURAN (NEMATI-CIDE) IN SOIL COLUMNS, Aligarh Muslim Univ. (India). Dept. of Biology. For primary bibliographic entry see Field 5B. W89-03297

INFLUENCE OF POTENTIAL EVAPORATION ON THE VARIABILITIES OF SIMULATED SOIL WETNESS AND CLIMATE, National Oceanic and Atmospheric Administra-tion, Princeton, NJ. Geophysical Fluid Dynamics

For primary bibliographic entry see Field 2D. W89-03308

2H. Lakes

INTERACTIONS OF SPHAGNUM WITH WATER AND AIR, Queen Mary Coll., London (England). School of Biological Sciences. R. S. Clymo.

R. S. Clymo. IN: Effects of Atmospheric Pollutants on Forests, Wetlands, and Agricultural Ecosystems. Springer-Verlag, New York. 1987. p 513-529, 4 fig, 35 ref.

Descriptors: *Acidification, *Water sources, *Peat bogs, *Soil chemistry, *Chemical properties, *Sphagnum, *Aquatic plants, *Cation exchange, Air pollution, Chemistry of precipita-

tion, Vegetation, Carbon dioxide, Soil organic

Peat-accumulating wetlands occupy 2-3% of the earth's land surface. Sphagnum, an important constituent of much of the peatland vegetation, is responsible for initiating acid conditions in ombrotrophic bogs and, because it decays disproportionately slowly, becomes over-represented in peat. Some general interactions between Sphagnum and water chemistry, and some possible effects on the peat-accumulation process are considered. Several features of Sphagnum physiology are important: (1) the plant produces polyuronic acids which, by cation exchange, release H+ into the bog water; (2) it is sensitive to the combination of high pH and high Ca2+ concentration together, though not to each separately; (3) it is sensitive to even moderate high Ca2+ concentration together, though not to each separately; (3) it is sensitive to even moderate concentrations of o-phosphate, NO3(-) and NH(4+); and (4) it is sensitive to moderate concentrations of HSO3(-). Cation exchange may be an important source of acidity in some bogs but is probably less important generally than was once thought. The role of colored organic acids as primary sources of acid is not clear. Acid rain has not been shown to affect Sphagnum, but atmospheric pollution in the wide sense is responsible for its disappearance from badly polluted areas of the southern Pennines. Since the last glaciation, peatlands have been a 'sink' for atmospheric carbon, but some bogs in Europe, at least, are becoming lands have been a 'sink' for atmospheric carbon, but some bogs in Europe, at least, are becoming less effective as they approach the natural limit to their growth. Death of their vegetation, where it occurs, and mining of peat both contribute to increasing atmospheric CO2 concentration, the extent of which can only be guessed. Nor do we know how peatlands would respond to increased concentrations of CO2 in the atmosphere. (See also W89-02304) (Author's abstract) W89-02312

RESPONSES TO ACIDIC DEPOSITION IN OMBOTROPHIC MIRES IN THE U.K., Manchester Univ. (England). Dept. of Botany. For primary bibliographic entry see Field 5B. W89-02314

STRATIGRAPHIC RECORD OF ATMOSPHER-IC LOADING OF METALS AT THE OMBRO-TROPHIC BIG HEATH BOG, MT. DESERT ISLAND, MAINE, U.S.A., Maine Univ. at Orono. Dept. of Geological Sci-

ences.

For primary bibliographic entry see Field 5B.

PROTON CYCLING IN BOGS: GEOGRAPHICAL VARIATION IN NORTHEASTERN NORTH AMERICA,

Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering. For primary bibliographic entry see Field 5B. W89-02316

NEW APPROACHES TO MONITORING AQUATIC ECOSYSTEMS.

For primary bibliographic entry see Field 5A. W89-02317

COMPARISON OF LAKE SEDIMENTS AND OMBROTROPHIC PEAT DEPOSITS AS LONG-TERM MONITORS OF ATMOSPHERIC

POLLUTION,
Maine Univ. at Orono. Dept. of Geological Sciences.

For primary bibliographic entry see Field 5A. W89-02321

REVIEW OF THE CRATER LAKE LIMNOLO-

GICAL PROGRAMS,
Oregon State Univ., Corvallis. Coll. of Forestry.

IN: New Approaches to Monitoring Aquatic Eco-systems. American Society for Testing and Materi-als, Philadelphia, PA. 1987. p 58-69, 4 tab, 38 ref,

Lakes-Group 2H

Descriptors: *Crater Lake National Park, *Crater Lake, *Water quality, *Limnology, *Monitoring, Biological properties, Chemical properties, Physical properties, Trophic level.

In response to apparent changes in the water quality of Crater Lake, the National Park Service convened two workshops, early in 1982 to evaluate the lake data base and then sponsored the limnological studies the following summer. In September of 1982, Congress mandated he Secretary of the Interior to initiate a ten-year program to of the Interior to initiate a ten-year program to develop an adequate data base and an understanding of physical, chemical, and biological characteristics and processes of the lake. Development of the program from 1982 to 1985 is described. The main objective is to stress ecological relationships among trophic levels and environmental conditions to bring a more holistic approach to the baseline data in order to evaluate the hypothesis that the lake has changed. (See also W89-02317) (Author's abstract) W89-02322

ESTUARINE INVERTEBRATES AND FISH: SAMPLING DESIGN AND CONSTRAINTS FOR LONG-TERM MEASUREMENTS OF POPULATION DYNAMICS,

Smithsonian Environmental Research Center, Edgewater, MD. For primary bibliographic entry see Field 2L. W89-02327

MODELING THE RESPONSE OF LAKE-AQUI-FER SYSTEMS TO ACID PRECIPITATION, New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience. For primary bibliographic entry see Field 5C.

NATIONAL SURFACE WATER SURVEY, WESTERN LAKE SURVEY (PHASE I – SYN-OPTIC CHEMISTRY) QUALITY ASSURANCE

Lockheed Engineering and Management Services Co., Inc., Las Vegas, NV. M. E. Silverstein, S. K. Drouse, J. L. Engels, M. L. Faber, and T. E. Mitchell-Hall.

Available from the National Technical Information Available from the National Technical Information Service, Springfield, VA. 22161, as PB87-214862. Price codes: A06 in paper copy, A01 in microfiche. EPA Report No. EPA/600/8-87/026, June 1987. 107p, 26 fig, 13 tab, 16 ref, append. EPA Contract 68-03-3249.

Descriptors: *Water chemistry, *Acid rain, *Lim-nology, *Water analysis, *Data acquisition, Lakes, Streams, Surface water, Water quality, Monitor-ing, Water sampling, Field tests, National Surface Water Survey, Regional analysis.

The purpose of the National Surface Water Survey of the National Acid Precipitation Assessment Program is to evaluate the present water chemistry of lakes and streams, to determine the status of certain lakes and streams, to determine the status of certain biotic resources, and to select regionally representative surface waters for a long-term monitoring program to study changes in aquatic resources. The Western Lake Survey is part of the National Surface Water Survey. The quality assurance plan and the analytical methods used during Phase I of the Western Lake Survey are based on those used during Phase I of the Eastern Lake Survey; analytical laboratory methods are identical for the two surveys, but some of the field laboratory methods were modified for the Western Lake Survey. Samsurveys, but some of the field laboratory methods were modified for the Western Lake Survey. Sampling protocols are significantly different in that ground access as well as helicopter access was used to collect samples for the Western Lake Survey. This quality assurance plan describes in detail the quality assurance requirements and procedures that are unique to the Western Lake Survey - Phase I. Quality assurance requirements and procedures that were adopted verbatim from the Eastern Lake Survey - Phase I are referenced here and are discussed in detail in the quality assurance plan prepared for that survey. (Lantz-PTT) W89-02413

NUMERICAL MODEL FOR THE COMPUTA-TION OF RADIANCE DISTRIBUTIONS IN NATURAL WATERS WITH WIND-ROUGH-ENED SURFACES, PART II: USER'S GUIDE AND CODE LISTING, Joint Inst. for the Study of the Atmosphere and Ocean, Seattle, WA.

C. D. Mobley. Available from the National Technical Information Service, Springfield, VA. 22161 as PB88-246871. Price codes: A09 in paper copy; A01 in microfiche. NOAA Technical Memorandum ERL PMEL-81, July 1988. 170p, 4 append. Office of Naval Research Contract N0004-87-K-0525.

Descriptors: *Light intensity, *Albedo, *Waves, *Optical properties, *Wind, *Radiance, *Computer models, FORTRAN, Computer programs, Irradiance, K-functions, Natural waters, Mathematical

This report is a users' guide for and listing of the FORTRAN V computer code that implements a numerical procedure for computing radiance distributions in natural waters. General knowledge of the radiance distribution in a natural hydrosol, such as a lake or ocean, is a prerequisite for the solution of more specific problems in underwater visibility, remote sensing, photosynthesis, or climatology. Moreover, since radiance is the fundamental radiometric quantity, if the radiance distribution is known, then all other quantities of interest, such as the irradiances and K-functions are easily computed. The mathematical details of the numerical radiance model are described in a separate report. puted. The mathematical details of the numerical radiance model are described in a separate report. The present report describes how to run the computer model and addresses questions such as which routines perform which calculations, what input is required by the various programs, and what is the file structure of the overall program. (Lantz-PTT) W89-02414

LIMNOLOGICAL AND FISHERY STUDIES ON LAKE SHARPE, A MAIN-STEM MISSOU-RI RIVER RESERVOIR, 1964-1975, Fish and Wildlife Service, Washington, DC. F. C. June, L. G. Beckman, J. H. Elrod, G. K.

F. C. June, L. G. Beckman, J. H. Elfou, O. R. O'Bryan, and D. A. Vogel.

Available from the National Technical Information Service, Springfield, VA. 22161, as PB87-212700.

Price codes: A05 in paper copy, A01 in microfiche. Fish and Wildlife Technical Report 8, 1987. 83p.

Descriptors: *Limnology, *Reservoirs, *Dam effects, *Lake Sharpe, *Missouri River, South Dakota, Ecology, Plankton, Fish, Fisheries, Popu-

This compilation of papers revealed the results of studies carried out on Lake Sharpe, an upper Missouri River reservoir in central South Dakota, during the early years of impoundment. The work was conducted in 1965-75 by the Pierre (South Dakota) Biological Station of North Central Reservice Lawrice for Stations of North Central Reservice Lawrice and Papers 1981. Dakota) Biological Station of North Central Reservoir Investigations, National Reservoir Research Program, U.S. Fish and Wildlife Service. The overall aim of these studies to determine the ecological effects of impoundment and subsequent water management in this flow-through reservoir. Initial objectives were to describe the characteristics of the water and the biota; to investigate the relation between environmental changes and the biota, with particular emphasis on the fish stocks; and to provide some of the information required to enable the development of sound decisions about the use of the water and fish. The six papers assembled here include information on the general hydrography and synoptic limnology of the reserassembled here include information on the general hydrography and synoptic limnology of the reservoir; on the composition and abundance of plankton, benthos, and fish stocks; on some apparent interrelations among the fish stocks (especially young of the year) and between the fish stocks and their environment; and on the biology of three of the most important fishes - walleyes, yellow perch, and gizzard shad. (See W89-02424 thru W89-02429) (Lantz-PTT) W89-02423

PHYSICAL, CHEMICAL, AND BIOLOGICAL CHARACTERISTICS OF LAKE SHARPE, SOUTH DAKOTA, 1966-1975,

Fish and Wildlife Service, Pierre, SD. North Central Reservoir Investigations F. C. June.

IN: Limnological and Fishery Studies on Lake Sharpe, a Main-stem Missouri River Reservoir, 1964-1975. Fish and Wildlife Technical Report 8, 1987. p 1-20, 16 fig, 13 tab, 43 ref.

Descriptors: "Water chemistry, "Lake Sharpe, "Dam effects, "Limnology, "Missouri River, Zoo-plankton, Peaking, Coustaceans, Midges, Biologi-cal properties, South Dakota, Ecosystems, Water temperature, Turbidity, Phytoplankton.

Lake Sharpe, the most recent of six main-stem Missouri River reservoirs to be impounded, began to fill in November 11963 and became fully operational in July 1966. At full pool it is 137 km long, and has a surface area of 22,600 ha and a volume of 2.34 cu km. It is operated as a flow-through power generation system that reregulates discharges from upstream Lake Oahe. Major changes in the watermanagement regimen during 1966-75 were increased summer discharges beginning in 1969 and increased peaking operations beginning in 1973. Lake Sharpe had a relatively short aging process because it filled rapidly, the water level remained because it filled rapidly, the water level remained relatively stable, and the water-exchange rate was high. Consequently, most physical, chemical, and biological characteristics were remarkably uniform during 196-75. The temperature regimen was largely governed by inflow from Lake Oahe. Although the water mass warmed during summer, thermal stratification was generally transient, limited to the lower reservoir, and more common ed to the lower reservoir, and more common during periods of relatively low discharge rates in 1966-88 than in later years. Variation in turbidity was striking; the midsection of the reservoir was generally most turbid. Chemical ion composition of the water tended to be uniform; observed differences were localized and associated with tributary inflows. Phytoplankton abundance reached its highest levels during 1970-75. Composition of the zooplankton community changed during 1966-75; the abundance of cyclopoid copepods decreased and that of calanoid copenods and cladocerans and that of calanoid copepods and cladocerans increased. Total abundance varied during the 10-year period, but without apparent trend. Variation in abundance appeared to be associated with dism annuance appeared to be associated with discharge rate, water temperature, and turbidity. The benthic community in 1967-68 consisted mostly of chironomid larvae, which were uniformly distributed over the length of the reservoir. (See also W89-02423) (Author's abstract) W89-02424

ZOOPLANKTON BIOMASS EXCHANGE IN LAKE SHARPE, SOUTH DAKOTA, 1974-1975, Fish and Wildlife Service, Pierre, SD. North Central Reservoir Investigations.

trai Reservoir investigations.
G. K. O'Bryan, and F. C. June.
IN: Limnological and Fishery Studies on Lake
Sharpe, a Main-stem Missouri River Reservoir,
1964-1975. Fish and Wildlife Technical Report 8, 1987. p 21-29, 5 fig, 5 tab, 6 ref.

Descriptors: *Limnology, *Dam effects, *Popula-tion dynamics, *Zooplankton, *Missouri River, *Biomass, *Lake Sharpe, South Dakota, Lake Oahe, Dams, Fish, Ecosystems, Reservoirs, Aquat-

The relation between zooplankton density and biomass in the water released and the rate of water release from Lakes Oahe and Sharpe through Oahe and Big Bend dams was investigated during 1974-75. The relation of zooplankton density in water to the water release rate was inverse at Oahe Dam, but direct at Big Bend Dam. Differences in the denth and manner of water intake, water-level depth and manner of water intake, water-level regimen, thermal structure of the water masses of Lakes Oahe and Sharpe, and zooplankton behavior most likely accounted for these differences in relations. More zooplankton (in both numbers and biomass) was lost from Lake Sharpe through Big Bend Dam than was gained from Lake Oahe through Oahe Dam. Fish eggs and larvae - mostly freshwater drum (Aplodinotus grunniens) - cap-tured in the forebay of Big Bend Dam almost certainly passed the dam. No eggs or larvae were caught in collections made from water released at

Group 2H-Lakes

Oahe Dam. (See also W89-02423) (Author's abstract) W89-02425

RELATIVE ABUNDANCE AND DISTRIBU-TION OF YOUNG-OF-THE-YEAR FISHES AND MINNOWS IN LAKE SHARPE, SOUTH DAKOTA,
Fish and Wildlife Service, Pierre, SD. North Cen-

tral Reservoir Investigation

L. G. Beckman.

L. U. BECKMAN. IN: Limnological and Fishery Studies on Lake Sharpe, a Main-stem Missouri River Reservoir, 1964-1975. Fish and Wildlife Technical Report 8, 1987, p 30-45, 1 fig, 9 tab, 13 ref.

Descriptors: *Fish, *Limnology, *Missouri River, *Minnows, *Lake Sharpe, *Population density, South Dakota, Shad, Perch, Crappies, Walleye,

The apparent abundance and distribution of young-of-the-year fishes and minnows in Lake Sharpe, South Dakota, were determined from weekly or South Dakota, were determined from weekly or biweekly catches with a bag seine and bottom trawl in summer (June-September). Trends in catches with the two types of gear were usually similar, although the seine was more effective for catching most species. Abundance was usually highest in a single 400-ha backwater area. Hipple Lake (which alone accounted for about 40% of the total catch of nearly 347,000 fish during the 9-year period), and in the middle third of the reservoir. Catches were highest in midsummer for most species in all areas except the upper reservoir, where catches neaked in late summer, possibly due to catches peaked in late summer, possibly due to upstream migration of young fish. Gizzard shad upstream migration of young fish. Gizzard shad and yello perch accounted for more than 80% of the 9-year seine catch, and gizzard shad, yellow perch, black crappies, and white crappies accounted for 90% of the trawl catch. Catches of the principal species were highest in 1968, and were lower and relatively stable from 1972 to 1975. During 1971-75, catches of young-of-the-year walleyes, the primary game fish in Lake Sharpe, remained relatively stable; catches of freshwater drum, white bass, bigmouth buffalo, and smallmouth buffalo increased; and catches of most other species decreased. Stocks of minnows and young-of-the-year fishes tended to stabilize after 1971. Except for walleyes, predator species were greatly of-the-year issnes tended to stabilize after 1971. Except for walleyes, predator species were greatly reduced from earlier years, and most forage species had declined. Thus it appeared that the fish population structure in Lake Sharpe would continue to consist of a dominant predator (the walleye) supported by reduced populations of a variety of forage species. (See also W89-02423) (Author's abstract) stract) W89-02426

BIOLOGY OF THE WALLEYE IN LAKE SHARPE, SOUTH DAKOTA, 1964-1975, Fish and Wildlife Service, Pierre, SD. North Cen-

tral Reservoir Investigations

trai Reservoir investigations.

J. H. Elrod, F. C. June, and L. G. Beckman.

IN: Limnological and Fishery Studies on Lake
Sharpe, a Main-stem Missouri River Reservoir,

1964-1975. Fish and Wildlife Technical Report 8, 1987. p 46-60, 4 fig, 13 tab, 22 ref.

Descriptors: *Walleye, *Limnology, *Missouri River, *Lake Sharpe, *Biological studies, *Spawning, Fish populations, South Dakota, Fish physiology, Reservoirs.

Abundance of walleyes in Lake Sharpe, a 22,600 ha reservoir on the Missouri River in central South Dakota, increased during the first 4 years of impoundment (1964-67) and remained relatively stable through 1975. Gill-net catches during summer were highest in the lower reservoir, but upstream migrations resulted in high abundance in upstream migrations resulted in high abundance in the upper reservoir (taliwater of Oahe Dam) in October to May. Reproduction was successful each year; the strongest year classes developed in 1964 and 1968. Tributary embayments in midreservoir were the principal nurseries. Seine catches of young of the year provided a satisfactory index of year-class strength. Growth of young of the year averaged about 1 mm/day during summer each year. A decline in growth of adults after impound-

ment corresponded to an increase in abundance of walleyes and a concurrent decrease in abundance of forage fishes. Estimated mean annual mortality from ages is Nes. Estimated niean annual mortanual from from ges from ages 10 to IX was 0.50 for males and 0.48 for females. Sexual maturity was generally attained 1 year earlier by males than by females, and age at sexual maturity increased by about 1 year for both sexual maturity increased by about 1 year for both sexes during the first 12 years of impoundment. Mean lengths and percentages of sexually mature walleyes were highly correlated for males 3 or 4 years old and for females 4 or 5 years old. Female walleyes predominated at all ages in the 1964-68 year classes, which were formed when the walleye population was expanding, whereas males dominated the 1969-74 years classes, which were formed under conditions of higher walleye abundance and accommanding slower growth rates. Snawning of under conditions of nigner waiteye abundance and accompanying slower growth rates. Spawning of walleyes in Lake Sharpe probably peaked during early May. If annual production of forage fishes remains adequate, the walleye population in Lake Sharpe should continue to remain near the level that existed during 1968-75. (See also W89-02423) (Author's abstract) (Author's abstract) W89-02427

BIOLOGY OF THE YELLOW PERCH IN LAKE SHARPE, SOUTH DAKOTA, 1964-1975, Fish and Wildlife Service, Pierre, SD. North Cen-

Fish and Wildlife Service, Fierre, S.D. North Central Reservoir Investigations.

D. A. Vogel, and F. C. June.

IN: Limnological and Fishery Studies on Lake
Sharpe, a Main-stem Missouri River Reservoir,
1964-1975. Fish and Wildlife Technical Report 8, 1987. p 61-74, 6 fig, 9 tab, 21 ref.

Descriptors: *Limnology, *Missouri Rivers, *Biological studies, *Vellow perch, *Lake Sharpe, South Dakota, Spawning, Fish populations, Mortality, Fish physiology, Water temperature, Reserving

The yellow perch was studied during the first 12 years after impoundment of Lake Sharpe (1964-75), a 22,600-ha flow-through reservoir on the main-stem Missouri River in South Dakota. Yellow perch ranked second in abundance (after Yellow perch ranked second in abundance (after gizzard shad) in seine trawl catches of young of he year fishes and fifth in abundance in gill-net catches of adults. Abundance of both young and adult yellow perch decreased markedly (ca. 80%) during the study period. The authors attributed the decline to a reduction in the brood stock and a general degradation, but sedimentation and erosion, of spawning and nursery ground in tributary embayments. Growth of young of the year increased during 1967-75 and was inversely related to abundance. Mortality estimates for the young varied little from year to year. Growth of adults was variable, and no trend over time was detected. Fish of ages II and III dominated the gill-net catches; the oldest caught were age VII. The average annual survival rate of adults was lower for males (12%) than for females (20%). Most males were sexually mature at age I and females at age II. Spawning occurred from mid-April to mid-May at Spawning occurred from mid-April to mid-May at water temperatures of 8.9 to 11.8 C. Because of the water temperatures of 8.9 to 11.8 C. Because of the importance of young-of-the-year yellow perch as forage fish in Lake Sharpe, provision of spawning substrate in tributary embayments is suggested as a possible method of enhancing reproduction. (See also W89-02423) (Author's abstract) W89-02428

EARLY LIFE HISTORY AND WINTER MORTALITY OF GIZZARD SHAD IN LAKE SHARPE, SOUTH DAKOTA, Fish and Wildlife Service, Pierre, SD. North Central Reservoir Investigations.

F. C. June.

In: Limnological and Fishery Studies on Lake Sharpe, a Main-stem Missouri River Reservoir, 1964-1975. Fish and Wildlife Technical Report 8, 1987. p 75-83, 3 fig, 6 tab, 21 ref.

Descriptors: *Limnology, *Missouri River, *Biological studies, *Mortality, *Shad, *Lake Sharpe, Seasonal variation, Reservoirs, Fish populations, Growth, South Dakota, Water temperature.

This study of gizzard shad was conducted from 1967 to 1975 in Lake Sharpe, a 22,600-ha reservoir

in central South Dakota. The impoundment is at the northern limit of distribution of the species in the main-stem Missouri River impoundment system. The gizzard shad of Lake Sharpe is not morphologically distinct from populations inhabiting other inland waters. Young of the year general spent the summer in tributary embayments, were most abundant in midreservoir localities, and apparently moved upstream in fall in response to inflow of warm water from Lake Oahe During 1967-75, gizzard shad composed 56% of the total catch of young of the year in seines and 40% of that in travls. Seine catches were highest in 1968, decreased annually through 1972, rose sharply in 1973, and declined again in 1974-75. Growth rates of young of the year, and mean lengths attained, varied during the 9-year period, but no trend with time was detected. Summer mortality was relatively low; however, over-winter mortality of the ly low; however, over-winter mortality of the young of the year was seemingly complete in every year except 1967. Low water temperature in winter was judged to be the primary factor limiting the gizzard shad population in Lake Sharpe. (See also W89-02423) (Author's abstract) W89-02429

RESERVOIR SEDIMENTATION AND INFLU-ENCE OF FLUSHING, For primary bibliographic entry see Field 2J. W89-02457

BIOGEOCHEMISTRY OF LEAD-210 AND PO-LONIUM-210 IN FRESH WATERS AND SEDI-

Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2K. W89-02555

DETERMINATION OF EVAPORATION AND SEEPAGE LOSSES, UPPER LAKE MARY NEAR FLAGSTAFF, ARIZONA, Geological Survey, Tucson, AZ. Water Resources

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 87-4250, May 1988. 39p, 14 fig, 6 tab, 6 ref.

Descriptors: *Lake evaporation, *Seepage, *Infil-tration, *Arizona, *Surface-groundwater relations, *Evaporation, Flagstaff, Upper Lake Mary, Moun-tain lakes, Limnology.

Two mass-transfer equations were developed to ompute evaporation as a part of the evaporation were seepage-loss study for the Upper Lake Mary Reservoir near Flagstaff, Arizona, which has a capacity of 15,620 acre-feet and a surface area of 876 acres. The mass-transfer equations do not require an independent measure of evaporation to define the mass-transfer coefficient. Data from define the mass-transfer coefficient Data from other evaporation studies were used to define the mass-transfer coefficient as a function of wind shear and atmospheric stability. Long-term seepage losses were determined by use of a seepage-probalosses were determined by use of a seepage-probability curve-derived from a stage-seepage relation and defined by several selected short-term water budgets-and a lake-stage probability curve. Seepage curves were derived for several different amounts of assumed reservoir sealing. The long-term water saving that would result from each increment of lake-bottom sealing were computed. The study revealed that the evaporation loss was 27 percent of 2,100 acre-feet per year of the total reservoir inflow during 1950-71; seepage loss was 45 percent or 3,500 acre-feet per year. (USGS) W89-02558

WATER QUALITY ASSESSMENT OF ARVADA RESERVOIR, DENVER METROPOLITAN AREA, COLORADO, Geological Survey, Denver, CO. Water Resources

Div.
L. J. Britton, and N. G. Gaggiani.
Available from OFSS, USGS, Box 25425, Denver,
CO 80225. USGS Water Resources Investigations
Report 87-4107, 1987. 66p, 22 fig, 10 tab, 62 ref.

Lakes-Group 2H

Descriptors: *Reservoirs, *Water quality, *Water properties, *Limnology, *Colorado, *Trophic level, Limiting nutrients, Water pollution sources, Water pollution effects.

Water quality data were collected from Arvada Reservoir, Colorado, and from its major inflows, Ralston Creek and Croke Canal, to assess the water quality of the reservoir, to evaluate the effect of water from various sources on the reservoir, and to estimate the trophic state of the reservoir. Data were collected at five sites in Arvada Reservoir, one site in Ralston Creek, and two sites Reservoir, one site in Raiston Creek, and two sites in Croke Canal. The study began in June 1983 (just before filling in May 1984) and continued through September 1985. The reservoir was thermally stratified on most sampling dates from April through September. Dissolved-oxygen concentrations ranged from 0 to 12.0 milligrams per liter, tions ranged from 0 to 12.0 milligrams per liter, and the reservoir was anaerobic below the 10-meter depth during most of the summer. Secchi-disk-depth measurements ranged from 0.9 to 5.5 meters and generally increased during the study period, possibly because of decreases in nonalgal turbidity after the reservoir was filled. Water from the reservoir generally is of suitable quality for a raw-water-supply source and for maintenage of raw-water-supply source and for maintenance of aquatic life. Total-nitrogen and total-phosphorus concentrations were small, and both were growthconcentrations were small, and doth were growth-limiting factors in the reservoir. The phytoplank-ton community was diverse, and the most domi-nant taxa were diatoms. Phytoplankton densities ranged from 1,400 to 29,000 cells per millimeter, and chlorophyll alpha concentrations ranged from 0.0 to 20.4 micrograms per liter. (USGS)

METHODS FOR COLLECTION AND ANALY-SIS OF AQUATIC BIOLOGICAL AND MICRO-BIOLOGICAL SAMPLES, Geological Survey, Lakewood, CO. Water Re-

For primary bibliographic entry see Field 7B. W89-02568

WATER QUALITY OF CANYON LAKE, CENTRAL TEXAS,

Geological Survey, Austin, TX. Water Resources

Div.
W. R. Roddy, and K. M. Waddell.
Available from OFSS, USGS, Box 25425, Denver,
CO 80225. Texas Department of Water Resources
Investigations Report 302, 1987. 59p, 14 fig, 11 tab,

Descriptors: *Texas, *Water quality, *Surface water, *Reservoirs, Stratification, Dissolved solids, Chlorides, Sulfates, Hardness, Dissolved oxygen, Iron, Manganese, Ammonia, Nitrogen, Phospho-rus, Canyon Lake, Guadalupe River.

The volume-weighted average concentrations of the principal dissolved constituents in Canyon Lake on the Guadalupe River in central Texas susually are less than 240 milligrams per liter of dissolved solids, 20 milligrams per liter of chloride, and 30 milligrams per liter of sulfate. The water, which is very hard, has a volume-weighted aver-age concentration of hardness of about 200 milli-grams per liter. Thermal stratification of the lake results in significant seasonal and areal variations in dissolved oxygen, which in turn result in greater grams per itter. Thermal stratification of the lake results in significant seasonal and areal variations in dissolved oxygen, which in turn result in greater summer concentrations of dissolved iron, dissolved manganese, and total ammonia during the summer. At a deep site on an arm of Canyon Lake, concentration of dissolved manganese averaged 390 micrograms per liter during the summer. The concentrations of total ammonia in the lake usually were less than 0.2 milligram per liter except in the hypolimnion during summer stagnation when nitrate and nitrite are reduced to ammonia. The closure of Canyon Dam resulted in a change in the monthly average water temperature of the Guadalupe River downstream from the dam. Prior to closure, the maximum monthly average water temperature for the Guadalupe River near Sattler, which was 29.0 C, occurred during June or July. Since closure, the maximum monthly average water temperature, which is 19.0 C, occurs during September or November. (USGS)

COMBINING FIELD MEASUREMENTS FOR SPECIATION IN NON PERTURBABLE WATER SAMPLES: APPLICATION TO THE IRON AND SULFIDE CYCLES IN A EUTRO-PHIC LAKE, (Switzerland). Dept. of Inorganic,

Analytical and Applied Chemistry.
For primary bibliographic entry see Field 5B.
W89-02645

DJINNANG II: A FACILITY TO STUDY MIXING IN STRATIFIED WATERS, Western Australia Univ., Nedlands. Dept. of Civil

For primary bibliographic entry see Field 7B. W89-02701 Engineering.

SPIRIT LAKE, MOUNT ST. HELENS, WASH-INGTON, LIMNOLOGICAL AND BACTERIO-LOGICAL INVESTIGATIONS. FINAL REPORT, VOLUME I, Army Engineer District, Portland, OR. D. W. Larson, and M. W. Glass.

D. W. Latson, and M. W. Class. Available from the National Technical Information Service, Springfield, VA. 22161, as AD-A182 836. Price codes: A14 in paper copy, A01 in microfiche. March 1987. 307p, 38 fig, 88 tab, 132 ref.

Descriptors: *Water quality, *Spirit Lake, *Lim-nology, Washington, Volcanoes, Bacterial analysis, Thermal stratification, Hydrogen sulfide, Ammo-nia, Iron, Manganese, Organic compounds, Light penetration, Turbidity, Species composition, Colo-stration

The cataclysmic eruption of Mount St. Helens, Washington, on May 18, 1980, filled nearby Spirit Lake with timber and volcanic debris and completely blocked the lake's natural outlet. The lake, which the outlet had previously kept in hydrological balance, was impounded in a closed, hydrologically unstable basin by a debris dam 150-180 m thick. This event greatly altered the limnology of Spirit Lake and resulted in extremely poor water quality. This report describes the post-eruption imnological recovery of Spirit Lake, from 1980 to 1986. Other topics of discussion include the limnological impacts of lake drawdown, the effects of logical impacts of lake drawdown, the effects of Spirit Lake release flows on receiving waters in the North Fork Toutle River basin, and the bacte-riology of lakes and rivers in the Mount St. Helens blast zone. Principal findings include: (1) the quality of Spirit Lake has improved immensely since ity of Spirit Lake has improved immensely since 1980; (2) the lake is now well-oxygenated except during summer thermal stratification when the hypolimnion becomes anoxic; (3) During summer thermal stratification, various potential water pollutants such as hydrogen sulfide, ammonia, reduced iron and manganese, methane, and dissolved organic compounds accumulate in the hypolimnion under anoxic conditions (4) concentrations of most organic compounds accumulate in the hypolimnion under anoxic conditions; (4) concentrations of most ionic constituents, particularly iron and manganese, have diminished considerably in the lake, some close to pre-eruption levels; (5) the clarity of the lake is now such that light can penetrate to at least 20 m, as opposed to < Im in 1980; (6) greater lake water clarity has contributed to the recovery lake water clarity has contributed to the recovery of the phytoplankton community, which now includes at least 135 species; and (7) species of several bacteria and coliforms, are still found frequently from monitoring sites throughout the area, and includes Klebsiella pneumonia, Pseudonomas aeruginosa, and Legionella sp. (See also W89-02710) (Lantz-PTT) W89-02700 W89-02709

SPIRIT LAKE, MOUNT ST. HELENS, WASH-INGTON, LIMNOLOGICAL AND BACTERIO-LOGICAL INVESTIGATIONS. FINAL REPORT, VOLUME II, APPENDICES, Army Engineer District, Portland, OR. D. W. Larson, and M. W. Glass.

D. W. Larson, and M. W. Olass. Available from the National Technical Information Service, Springfield, VA. 22161, as AD-A182 837. Price codes: A06 in paper copy, A01 in microfiche. March 1987. 140p.

Descriptors: *Water quality, *Spirit Lake, *Lim-nology, Washington, Bacterial analysis, Thermal stratification, Hydrogen sulfide, Ammonia, Iron,

Manganese, Organic compounds, Light penetra-tion, Turbidity.

Spirit Lake, near Mount St. Helens, Washington, was impounded in a 1980 closed, hydrologically unstable basin by a debris dam 150-180 m thick. Post-eruption limnological recovery of Spirit Lake was examined from 1980 to 1986. This volume contains the appendices to Volume I, that actual report on the recovery process in Spirit Lake. The appendices contain results of water analyses, light pentration data, and temperature profiles; water analytical techniques and statistical analyses; and temperature and dissolved oxygen profiles (graphs) (See also W89-02709) (Lantz-PTT)

NEW DIRECTIONS IN KARST.

For primary bibliographic entry see Field 2F. W89-02728

NATURAL HISTORY OF LAKES,

City of London Polytechnic (England). Biological

M. J. Burgis, and P. Morris. Cambridge University Press, New York. 218p.

Descriptors: *Limnology, *Lakes, *History, *Eco-systems, Lake shores, Seasonal variation, Reser-voirs, Mountain lakes, Polar regions, Tropical re-gions, Saline water, Arctic regions, Water temper-ature, Lake morphology.

Despite their distinct shorelines, lakes are not isolated but constantly interact with their surroundings. The properties of lake water, the formation of lakes, their seasonal patterns, and the communities ings. The properties of lake water, the formation of lakes, their seasonal patterns, and the communities of plants and animals that they support are described. The characteristics of the world's lakes are then described as follows: polar and mountain lakes; deep lakes, saline and soda lakes; and manmade lakes. The use and abuse of lakes and lake conservation issues also are considered. (Lantz-PTT) W89-02775

MARTINS FORK LAKE SEDIMENTATION STUDY: HYDRAULIC MODEL INVESTIGA-

Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab. For primary bibliographic entry see Field 2J. W89-02780

TREATMENT OF FILTER EFFLUENTS FROM DEWATERING OF SLUDGES BY A NEW HIGH PERFORMANCE FLOCCULATION RE-

ACTOR,
Technische Univ. Berlin (Germany, F.R.). Inst. fuer Chemieingenieurtechnik.
For primary bibliographic entry see Field 5D. W89-02819

INTENSIVE SURVEY OF THE DUPAGE RIVER BASIN, 1983.

Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control. For primary bibliographic entry see Field 5G. W89-02829

INTENSIVE SURVEY OF THE FOX RIVER BASIN FROM THE WISCONSIN STATE LINE TO OTTAWA, ILLINOIS: 1982.
Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control. For primary bibliographic entry see Field 5G. W89-02841

DYNAMIC RESERVOIR INTERACTION WITH MONTICELLO DAM, California Univ., Richmond. Earthquake Engineer-

ing Research Center.
For primary bibliographic entry see Field 8A.

Group 2H-Lakes

CHEMICAL AND BIOLOGICAL SURVEY OF LAKES AND STREAMS LOCATED IN THE EMERALD LAKE WATERSHED, SEQUOIA NATIONAL PARK,

California Univ., Santa Barbara. Marine Science

J. M. Melack, S. D. Cooper, R. W. Holmes, J. O. Sickman, and K. Kratz.

Sickman, and K. Krätz.
Available from the National Technical Information
Service, Springfield, VA. 22161, as PB88-180872.
Price codes: Al4 in paper copy, A01 in microfiche.
Final Report, February 18, 1987. 345p, 118 fig., 33
tab, 325 ref. California Air Resources Board Contract A3-096-32.

Descriptors: *Water analysis, *Water quality, *Streams, *Biological studies, *Lakes, *California, *Limnology, Hydrogen ion concentration, Season-al variation, Sulfates, Nitrates, Ammonium, Nitrogen, Chlorophyll, Phytoplankton, Phosphorus, Empandel Chamball, *Streams of the Chamball gen, Chlorop Emerald Lake.

Emerald Lake is located at an elevation of 2780 m in the Sierra Nevada. The lake has one surface outflow and is fed by several inflowing streams that drain a ca. 113 ha catchment; it is 2.85 ha in area and has a maximum depth of 10.5 m. Emerald Lake contains calcium-bicarbonate water with Lake contains calcium-bicarbonate water with very low acid neutralizing capacity as is typical of high-altitude lakes in the Sierra Nevada. Its current pH (5.6-6.6) is near the low end of the range observed in Sierran lakes. Low values (5.6-6.0) are observed in Sierran lakes. Low values (5.6-6.0) are associated with intense summer rains and snowmelt. During ice-cover and mid-summer the lake is thermally stratified and low DO and elevated concentrations of ammonium, base cations and acid neutralizing capacity (ANC) develop in the deeper water. The major contributors to alkalinity generation in Emerald Lake from the sediments are ammonium production from the breakdown of organic matter (446%) and the archange of hydrogen in the contract of hydrogen ic matter (44%) and the exchange of hydrogen ion for calcium in the sediments (34%). During the initial stages of snowmelt in 1986, sulfate and niinitial stages of snowment in 1986, sulfate and natrate concentrations increased while base cations and ANC declined in the subsurface water being influenced by runoff. Inflows varied in pH from 5.7 to 6.5 with minima during snowmelt; inflow ANC ranged from 4 to 45 microeg/L with minima during intense summer rain and snowmelt. Phytostakter and snowmelt. Phytostakter and snowmelt. Phytostakter and snowmelt. during intense summer rain and snowmelt. Phytoplankton productivity as measured using tracer techniques employing isotopes of nitrogen (15-N) and carbon (14-C) were low during the ice-free seasons of 1984 and 1985. Ammonium uptake rate, particulate nitrogen and chlorophyll were used as indices of phytoplankton response to experimental additions of the acids and nutrients associated with acid precipitation to replicated 3000-4000 liter bags suspended in Emerald Lake. Equations which estimate pH and ANC in high-elevation Sierra Nevada lakes from the species composition of diatom assemblages indicate that both pH and ANC have varied somewhat since about 1825, but there is no overall trend in either of these variables. (Lantz-PIT) bles. (Lantz-PTT)

SURVEY OF SENSITIVITY OF SOUTHERN CALIFORNIA LAKES TO ACID DEPOSITION, California Univ., Santa Barbara. Dept. of Biological Sciences.

For primary bibliographic entry see Field 5C.

VOLUNTEER LAKE MONITORING PROGRAM, 1987. VOLUME I: STATEWIDE SUM-

MARY REPORT,
Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control. For primary bibliographic entry see Field 7B. W89-02869

PRELIMINARY ENVIRONMENTAL ASSESSMENT OF THE CONTAMINATION ASSOCIATED WITH LAKE CALUMET, COOK COUNTY, ILLINOIS,

Illinois State Water Survey Div., Savoy. Hazard-ous Waste Research and Information Center. For primary bibliographic entry see Field 5B. W89-02870

TEMPERATURE ANALYSIS, HOWARD A. HANSON RESERVOIR, WASHINGTON: MATHEMATICAL MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
M. L. Schneider, and R. E. Price.
Available from the National Technical Information

Available High He National Technical Information Service, Springfield, VA. 22161. Technical Report HL-88-22, September 1988. Final Report. 85p, 32 fig, 3 tab, 12 ref, 3 append.

Descriptors: *Washington, *Water temperature, *Howard A. Hanson Reservoir, *Mathematical models, *Reservoirs, Model studies, Water depth, Water storage, Thermal water

The US Army Engineer District, Seattle, is presently evaluating the impacts of proposed additional water storage at Howard A. Hanson Reservoir in Washington State. This proposed modification will involve raising the existing pool approximately 40 ft. The investigation reported herein examined the impacts of raising the conservation pool on the reservoir thermal profiles and release temperatures for several study years. The mathematical model used in this study examined impacts of raising the pool with and without structural modification to the existing outlet works. Optimization procedures were used with the mathematical model to provide an optimum number of and elevations for the addian optimum number of and elevations for the additional ports. Results indicated that significant improvement in release temperatures for the raised pool could be achieved with a multilevel outlet structure as compared to the existing outlet works. structure as compared to the existing outlet works. The method for calculating the reliability index is given in Appendix A. Appendix B lists monthly temperature release statistics for existing conditions, and Appendix C lists the calculated average release temperatures for the reservoir. (Author's abstract) W89-02877

RUNOFF AND SEDIMENT PRODUCTION IN A SMALL PEAT-COVERED CATCHMENT: SOME PRELIMINARY RESULTS, Huddersfield Polytechnic (England). Dept. of Ge-

For primary bibliographic entry see Field 2E. W89-02888

OHIO STREAM REGIONALIZATION PROJECT: A COMPENDIUM OF RESULTS, Northrop Services, Inc., Corvallis, OR. T. R. Whitter, D. P. Larsen, R. M. Hughes, C. M.

1. K. Whittier, D. P. Larsen, R. M. Hugnes, C. M. Rohm, and A. L. Gallant. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-204227. Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA/600/3-87/025, May 1988. 66p, 21 fig, 8 tab, 42 ref, append.

Descriptors: *Ohio, *Ecology, *Streams, *Water quality, Fish, Habitats, Macroinvertebrates, Monitoring, Ecosystems, Aquatic environment.

Regional patterns in terrestrial characteristics can Regional patterns in terrestrial characteristics can be used as a framework to monitor, assess and report the health of aquatic ecosystems. In Ohio, five ecological regions were delineated using combinations of spatial patterns in land-surface form, land use, soil and potential natural vegetation. This framework was represented by terthiers the united. land use, soil and potential natural vegetation. This framework was evaluated by studying the water quality, physical habitat, and fish and microinvertebrate assemblages of 109 minimally impacted representative streams. Water quality and fish assemblages showed clear regional differences. The highest quality water and fish assemblages were consistently found in the southeast ecoregion and the lowest quality in the northwest ecoregion. No clear regional patterns were found in macroinvertebrate assemblages and limited regional patterns in physical habitat. (Author's abstract) W89-02932

EFFECTS OF STEADY VERSUS FLUCTUATING FLOWS ON AQUATIC MACROINVERTEBRATES IN THE COLORADO RIVER BELOW GLEN CANYON DAM, ARIZONA,
Arizona Game and Fish Dept., Phoenix.
For primary bibliographic entry see Field 6G.

W89-02940

WESTERN LAKE SURVEY, PHASE I, DATA BASE.

BASE.
Environmental Protection Agency, Washington, DC. Office of Acid Deposition, Environmental Monitoring, and Quality Assurance.
Available from the National Technical Information Service, Springfield, VA 22161, as PB8-200753.
Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA/600/44-87/027, September 1987.
114p, 5 fig. 8 tab, 15 ref, 2 append. EPA Contract 68-03-3246, 68-02-3889, 68-03-3050, and 68-02-3889.

Descriptors: *Acid rain effects, *Lakes, *Surveys, Limnology, Lake morphology, Colorado, Washington, Nevada, California, Wyoming, Utah, Montana, Hydrogen ion concentration, Acidic waters, Water quality, Classification.

A total of 973 probability sample lakes was selected from the map population in the Western U.S. Of those, 94 were classified as non-target by examination of large-scale maps, 98 were classified as non-target when visited, and 60 were not visited. Data from water samples collected from 720 lakes were from water samples collected from 720 lakes were subsequently considered for use in making population estimates. One lake which was larger than 2000 ha was excluded from population estimates thus, the number of lakes upon which population estimates are based is 719. Of the 719 probability sample lakes, 455 were located in wilderness areas. The largest numbers of probability sample lakes were sampled in the states of California (147), Colorado (132), and Washington (117). Only two lakes were sampled in Nevada and one in New Mexico. Most of the special interest lakes sampled were located in Montana (8), Utah (7), and Wyoming (7). Based on the sample size of the probability sample lakes, and using the equations developed to extrapolate to the total number of target lakes, it is estimated that the number of lakes characterized by the WLS-1 is 10,393 with a standard error of 219.4. Five of the chemical variables measured during the WLS-1 were selected for detailed analysis because of their direct relevance to the effects exiétic descritten en lake chemicaty (1) all. Is during the WLS-1 Were selected for detailed analysis because of their direct relevance to the effects of acidic deposition on lake chemistry: (1) pH - In some lakes, continuous inputs of acids can result in decreases in pH and acid neutralizing capacity, and (2) ANC - In other lakes, acid neutralizing capacity. (a) ANC - in other takes, acto neutralizing capacity may decrease before substantial decreases in pH occur; therefore, losses in acid neutralizing capacity may serve as a better indicator of acidification than decreases in pH. (3) Sulfate - Sulfate concentrations of the concentration of the concentrati trations in lake water can become elevated as a result of sulfate deposition, one of the key components of acidic deposition. (4) Extractable Aluminum -- Acidification of lakes can be accompanied by elevated concentrations of aluminum that can by elevated concentrations of autimum that can be toxic to aquatic organisms, particularly fish and (5) organic acids of terrestrial origin. These com-pounds can serve as sources of hydrogen ion (i.e., acidity). Thus, some acidic lakes may be so because of the presence of organic acids and not necessarily because of acidic deposition. (Lantz-PTT) W89-02946

ECOLOGICAL RESEARCH ON SOUTH AFRICAN RIVERS - A PRELIMINARY SYNTHESIS, Council for Scientific and Industrial Research, Precina (South Africa). Foundation for Research Development. J. H. O'Keeffe

Available from the National Technical Information Service, Springfield, VA 22161, as PB88-191044. Price codes: E07 in paper copy, E07 in microfiche. 121p, 3 fig, 5 tab, 555 ref.

Descriptors: *Limnology, *Hydrobiology, *Rivers, *South Africa, Flow profiles, Flow rate, Water quality, Silt, Temperature, Aquaticvegeta-tion, Fish, Diatoms, Invertebrates, Conservation, Literature review.

Ecological research on South African rivers has progressed in a number of phases. The realization that South African rivers were deteriorating in the face of overexploitation, led to a coordinated research program by the National Institute for Water Research in the 1950's and 1960's, which included

Lakes-Group 2H

in-depth studies on representative rivers such as the Great Berg, the Tugela, the Jukskei/Crocodile and the Vaal. Major advances resulted from this and the Vaal. Major advances resulted from this program, including the description of physical zonation along rivers, and the associated changes in the biotic community; the identification of the main factors limiting species distributions in rivers, such as temperature, silt, food availability and flow rate. The literature on South African river ecology is reviewed, and available knowledge on inverteis reviewed, and available knowledge on inverte-brates, diatoms, fish and other vertebrates, and plants is summarized. Activities involving the con-servation of rivers include the identification of threats to specific rivers and environmental impact assessments. (Lantz-PTT) W89-0/2982.

CONSERVATION OF SOUTH AFRICAN

Council for Scientific and Industrial Research, Pre-toria (South Africa). Foundation for Research Development. J. H. O'Keeffe.

Available from the National Technical Information Service, Springfield, VA 22161, as PB88-191051. Price codes: E07 in paper copy, E07 in microfiche. 1986, 117p.

Descriptors: *South Africa, *Rivers, *Water conservation, Management planning, Water management, Legislation, Ecology, Monitoring.

The proceedings of a three-day workshop at Midmar Dam, Natal, designed to establish a consensus view of river conservation and to provide professional conservationists, managers and planners with a set of guidelines presents what is known about the ecology of South African rivers, what options are available for monitoring and managing them, what legislation is available for controlling the exploitation of rivers and what research priorities should be implemented to increase the understanding of river ecology. (See W89-02986 thu W89-02993) (Author's abstract)

RIVERINE ECOSYSTEMS, Cape Town Univ. (South Africa). Dept. of Zoolo-

gy. J. A. Day, B. R. Davies, and J. M. King. IN: Conservation of South African Rivers. 1986. p 1-18, 5 fig, 28 ref.

Descriptors: *Rivers, *Ecosystems, *South Africa, *Limnology, Ecological effects, Water use, Water resources development, Salinity, Eutrophication, Estuaries, Land use, River regulations, River sys-

Since water will soon be the factor limiting the economic prosperity of South Africa, it is clear that this country's rivers will continue to be exthat this country's rivers will continue to be ex-ploited to the greatest possible extent. It is neces-sary, therefore, to consider the effects that this will have on the rivers themselves. Not only are rivers ecologically, aesthetically and recreationally im-portant parts of the landscape, but their biota is able to cleanse their waters, making them available able to cleanse their waters, making them available for further human use. As yet there is no policy for the conservation or preservation of any South African rivers and no legislation directed specifically at preventing their abuse as functioning ecosystems. The physical and ecological properties of rivers are described in order to set the scene for subsequent discussion of the uses and abuses of subsequent discussion of the uses and abuses of rivers, the need for their conservation and how this might be brought about. (See also W89-02985) (Lantz-PTT) W89-02986

CONSERVATION AIMS, CRITERIA, AND GOALS FOR RIVERS, Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies. J. H. O'Keeffe.

IN: Conservation of South African Rivers. 1986. p. 19-23, 2 ref.

Descriptors: *Water conservation, *Conservation, *South Africa, *Rivers, Water resources develop-

ment, Ecology, Flow profiles, Geology, Public

The definition of a philosophy and criteria for river conservation has immediately identified the general goals which should be aimed at: the maintenance of diversity of function, the sustainable utilization of resources, the maintenance of ecosystem functioning, and the preservation of representative types of rivers. To be able to maintain the diversity of function of rivers requires the achievement of a number of specific goals. The functions must be identified and their controlling processes understood, so that the effects of perturbations can be predicted and mitigation methods suggested. The development of methods for the assessment of the conservation costs of river exploitation schemes is therefore a primary coal. Because of the ce of diversity of function, the su schemes is therefore a primary goal. Because of the difference in emphasis on the use of different rivers difference in emphasis on the use of different rivers it will be necessary to formulate a number of different management policies to take account of the continuum from pristine to degraded and small to large rivers. It may be most effective to formulate individual river management plans. The sustainable utilization of river resources requires research for the prediction of exploitable levels as well as the development of alternative technologies, such as water recycling, to ease the pressure for over-exploitation. In addition, the inclusion of ecological expertise and the identification of conservation priorities as a matter of course, at the ecological expertise and the identification of conservation priorities as a matter of course, at the earliest planning stage of development projects, is an overriding priority. The maintenance of ecosystem functions underlies any attempt to preserve diversity of function. The preliminary necessity is research to identify and understand basic controlling processes. In the river itself the dominant controlling variable is the flow level, and an urgent priority is to identify flow requirements for the acceptable maintenance of essential functions. The preservation of representative types of rivers requires the classification of rivers by geographical region, by physical environmental type and by conservation status. (See also W89-02985) (Lantz-PTT)

RIVER RESPONSE TO CATCHMENT CONDI-TIONS, Jonkershoek Forest Research Station, Stellenbosch

Jonkershoek Forest Research Station, Stellenbosch (South Africa). J. M. Bosch, D. J. Alletson, A. F. M. G. Jacot Guillarmod, J. M. King, and C. A. Moore. IN: Conservation of South African Rivers. 1986. p 44-63, 6 fig, 2 tab, 33 ref.

Descriptors: *Rivers, *Catchment areas, *South Africa, *Water quality, Watersheds, Flow patterns, Riparian water, Soil composition, Climatology, Topology.

A catchment is the drainage basin of a river. Bounded by other catchments, its geographical area covers all the land that drains into one river from the source to the estuary. When area covers air the land that drains into one river system, from the source to the estuary. When water precipitates into a catchment, much of it is lost into the atmosphere by evapotranspiration. Most of the remainder moves downhill through the catchment, either as ground or surface water, and eventually drains into the river system. The speed with which this water moves through the speed with which this water moves through the catchment is dependent on the geology and topography of the area, while the impurities it collects along the way are characteristic of the types of bedrock, soils and land use within the catchment. Thus by the time the water reaches the stream, its quality has changed from that of rainwater, in a manner that reflects the nature of the catchment. With the river playing such a central role in the catchment, it follows that many catchment characteristics will have an important influence upon it. These characteristics will vary from those that directly affect only particular portions of a river (e.g., a point source pollutant), to those that affect (e.g., a point source pollutant), to those that affect the complete river system (e.g., the pattern of stormflow into the river). Some relevant catchment characteristics are: (1) geology - seasonal flow pattern, individual stormflow characteristics, subsurface flow pattern, water quality, erosion/ sedimentation, and human activities; (2) soils; (3) topography - size, shape, relief and gradients, and drainage density; (4) climate - precipitation and

temperature; (5) biosphere; and (6) riparian zones. (See also W89-02985) (Lantz-PTT) W89_02990

MONITORING AND SURVEILLANCE,

National Inst. for Water Research, Pretoria (South Africa). For primary bibliographic entry see Field 7B. W89-02991

RIVER CONSERVATION - IMPLICATIONS FOR LEGISLATION, Rhodes Univ., Grahamstown (South Africa). Dept. of Geography. For primary bibliographic entry see Field 6E. W89-02992

RESEARCH AND INFORMATION NEEDS.

Albany Museum, Grahamstown (South Africa).
J. A. Cambray, F. C. de Moor, A. J. Bath, and K.
C. D. Hamman.

C. D. Framman.
IN: Conservation of South African Rivers. 1986. p. 88-107, 2 fig, 3 tab, 29 ref, 2 append.

Descriptors: *Research priorities, *South Africa, *Information exchange, *Rivers, Ecology, River systems.

A list of potential research projects which need to be done to provide essential information on rivers in South Africa emphasizes an holistic view of research needs are considered. All the factors (biotic, abiotic, climatic, anthropogenic) which have an influence either directly or indirectly on the river environment. A list of research project proposals is provided in an Appendix. (See also W89-02985) (Lantz-PTT) W89-02993

HYDROLOGY AND CHEMISTRY OF SELECT-ED PRAIRIE WETLANDS IN THE COTTON-WOOD LAKE AREA, STUTSMAN COUNTY, NORTH DAKOTA, 1979-82,

Geological Survey, Lakewood, CO. J. W. Labaugh, T. C. Winter, V. A. Adomaitis, and G. A. Swanson.

Available from Books and Open-File Reports Section, USGS, Box 25425, Denver, CO 80225. USGS Professional Paper 1431, 1987. 26p, 14 fig. 39 ref.

Descriptors: *Wetlands, *Chemical properties, *Prairies, *North Dakota, *Geochemistry, Nutrients, Wells, Potassium, Calcium, Magnesium, Bicarbonate, Groundwater recharge, Groundwater movement, Hydrology.

The relation of hydrologic setting and temporal variability in hydrology to nutrient content and geochemical characteristics of a group of prairie wetlands and adjacent groundwater was studied during the period 1979-82. Emphasis is on four wetlands, two seasonal and two semipermanent, and four wells contiguous to them along a hydrologic section. The seasonal wetlands, 18 and T3, contained water only for a few weeks to months after filling in spring and early summer; both were completely dry by August. The semipermanent wetlands, P1 and P8, contained water throughout each year and were ice covered in winter. Significant differences existed in the chemical composition of the wetlands based on their hydrologic setting. The dominant cation and anion in the wetlands were potassium and bicarbonate in wetland T8, calcium and sulfate in wetland T3, magnesium and bicarbonate in wetland P8. Significant seasonal differences existed in the water chemistry of the wetland in groundwater discharge areas. Concentrations of total phosphorus and total nitrogen were greatest in wetlands in areas of groundwater discharge. Differences in the chemistry of water from wells in the adjacent ground water resulted primarily from the positions of the wells in the groundwater flow system. (Author's abstract) W89-03035 wetlands and adjacent groundwater was studied during the period 1979-82. Emphasis is on four

Group 2H-Lakes

AQUATIC MACROPHYTES IN ADIRONDACK (NEW YORK) LAKES: PATTERNS OF SPECIES COMPOSITION IN RELATION TO ENVIRON-

Indiana Univ. at Bloomington. Dept. of Biology. For primary bibliographic entry see Field 5C. W89-03056

DIVERSITY OF THE PARASITE ASSEMBLAGE OF FUNDULUS ZEBRINUS IN THE PLATTE RIVER OF NEBRASKA, Nebraska Univ.-Lincoln. School of Biological Sci-

ences. J. Janovy, and E. L. Hardin. Journal of Parasitology, Vol. 74, No. 2, p 207-213, April 1988. 1 fig, 4 tab, 19 ref.

Descriptors: *Limnology, *Rivers, *Parasites, *Killifish, *Platte River, Fundulus, Streamflow, Population density, Nebraska, Hydrobiology.

Changes in the values of the Shannon H' diversity index as determined for individual hosts (infraassemblage diversity), host samples (sampling assemblage diversity), and for species density are reported for an assemblage of 7 parasites in Fundulus zebrinus in the Platte River in Nebraska for a 5-year period. The parasites were: Myxosoma funduli (gill), Trichodina sp. (gill), Gyrodactylus bulbacanthus (gill), Salsuginus sp. (gill), G. stableri (body surface), and Neascus sp. (= Posthodiplostomum; eyes and body cavity). Relative abundance and equitability are given for each of the study years. Mean infraassemblage diversity, sample assemblage diversity, species density, and equitability were all significantly negatively correlated with river streamflow (measured in cubic feet per second) of the year prior to the sample, but were independent of the concurrent year's streamflow. Over the long term, M. funduli and Trichodina sp. were the most, and G. bulbacanthus was the least, abundant. Species pair prevalence and relative density correlations showed few long-term patterns of co-occurrence or microallopatry. The strongest association was between M. funduli and the Neascus sp. and was attributed to similarities in ecological. Changes in the values of the Shannon H' diversity sp. and was attributed to similarities in ecological requirements of intermediate hosts. (Author's ab-

MODEL CALIBRATION BASED ON RANDOM ENVIRONMENTAL FLUCTUATIONS, Princeton Univ., NJ. Dept. of Civil Engineering and Operations Research.

For primary bibliographic entry see Field 7A. W89-03105

FATE OF ADDED ALKALINITY DURING NEUTRALIZATION OF ACID LAKE, Cornell Univ., Ithaca, NY. Dept. of Environmen-

tal Engineering.
For primary bibliographic entry see Field 5G. For primary W89-03111

INTERPRETATION OF 'CONTROLLED' VS 'NATURAL' EXPERIMENTS IN STREAMS, California Univ., Santa Barbara. Dept. of Biologi-

For primary bibliographic entry see Field 7A. W89-03117

EFFECTS OF THE BLUE-GREEN ALGA MI-CROCYSTIS AERUGINOSA ON ZOOPLANK-TON COMPETITIVE RELATIONS,

North Carolina Univ., Morehead City. Inst. of Marine Sciences.
R. S. Fulton, and H. W. Paerl.
Oecologia OECOBX, Vol. 76, No. 3, p 383-389,
August 1988. 3 fig, 39 ref.

Descriptors: *Algal blooms, *Ecology, *Cyano-phyta, *Zooplankton, Microcystis, Daphnia, Crus-taceans, Eutrophication, Rotifers.

Field distribution patterns and laboratory feeding experiments have suggested that blooms of colonial blue-green algae strongly inhibit relatively large-bodied daphnid cladocerans. Laboratory experi-

ments were conducted to test the hypothesis that ments were conducted to test the hypothesis trial blooms of the colonial blue-green alga Microcystis aeruginosa would shift competitive dominance away from large-bodied daphnid cladocerans toward smaller-bodied cladocerans, copepods, and toward smaller-bodied cladocerans, copepods, and rotifers. In laboratory competition experiments, increasing the proportion of M. aeruginosa in the algal food supply resulted in a shift from dominance by the relatively large-bodied cladoceran Daphnia ambigua to dominance by the smallbodied cladoceran Diaphanosoma brachyurum or the copepod Diaptomus reighardi. The smallbodied cladoceran Bosmina longirostris was always numerically heavily dominant over D. ambigua, but its estimated population biomasses were only slightly higher than those of D. ambigua. Daphnia ambigua consistently outcompeted the rotifer Brachionus calyciflorus. Blooms of M. aeruginosa can alter zooplankton competitive relations ther practionals callections. Blooms of M. aeru-ginosa can alter zooplankton competitive relations in laboratory experiments, favoring small-bodied cladocerans and copepods at the expense of large-bodied cladocerans. However, contrary to predictions, blooms of M. aeruginosa did not improve the competitive ability of rotifers. (Author's abstract) W89-03118

ACIDIFICATION AND SUCCESSION IN A FLOOD-PLAIN MIRE IN THE NORFOLK BROADLAND, U.K., Sheffield Univ. (England). Dept. of Botany. K. E. Giller, and B. D. Wheeler. Journal of Ecology JECOAB, Vol. 76, No. 3, p 849-866, September 1988. 10 fig, 1 tab, 33 ref.

Descriptors: *Ecology, *Acidification, *Sphagnum, *Bogs, *Wetlands, *Peat, *Fens, Flood plains, Acidity, Plant populations, Norfolk, England, Ombrotrophic conditions.

Sphagnum communities within rich-fen sites of the Norfolk Broadland were all of recent origin (<150 Spinaguin communities within incircles sites of time Norfolk Broadland were all of recent origin (<150 years old); there was no evidence of any relicts of a former ombrotrophic surface. The Sphagnum communities had mainly developed from Phragmites- and Typha-dominated vegetation, rarely over Cladium-dominated vegetation; no examples over Carex paniculata fen have been observed. There was evidence for progressive base-depletion in parts of the fens remote from the river. However, Sphagnum communities are not restricted to these places but are also developed in fen compartments with cation-rich water and adjacent to dykes and waterways with eutrophic water. Isolation from inundation by base-rich water is necessary for the development of Spahgnum lawns. Where Sphagnum has invaded fen compartments with base-rich waters, flooding is avoided by vertical movement of the peat surface which also prevents ont through floating rhizome rafts and, more commonly, by expansion and contraction of a loose peat matrix. The ultimate persistence of the commonly, by expansion and contraction of a loose peat matrix. The ultimate persistence of the Sphagnum communities is uncertain as tree establishment may lead to a depression of the peat surface and elimination of Sphagnum. In some mature Betula pubescens, forming a poor-fen community that may be a precursor of ombrotrophic conditions. (Author's abstract)

INDIRECT EFFECTS AND BIOLOGICAL CONTROL OF MOSQUITOES BY MOSQUITO-

California Univ., Santa Barbara. Dept. of Biologi-cal Sciences.

J. R. Bence.

Journal of Applied Ecology JAPEAI, Vol. 25, No. 2, p 505-521, August 1988. 7 fig, 7 tab, 35 ref,

Descriptors: *Invertebrates, *Mosquitoes, *Fish behavior, *Ecology, Biocontrol, Rice, Predation, Mosquitofish, Mosquitoes, California

The mosquitofish, Gambusia affinis (Baird and Girard), reduced the abundance of the pest mos-quito Culex tarsalis Coquillet in a rice field in San Joaquin Valley, California. The mosquitofish also reduced the abundance of other aquatic inverte-

brate taxa, including predatory insects and zoo-plankton. The reduction in predatory insect abun-dance, due to the fish, reduced mosquito mortality due to insects. The reduction in the abundance of due to insects. The reduction in the abundance of alternative prey (mainly zooplankton) increased predation rates on mosquitoes by individual fish. A low abundance of zooplankton increased the pre-dation rates of individual predatory insects. Suc-cessful control of mosquitoes results from a direct negative effect by mosquitofish that more than outweighs indirect positive effects of the mosquito-fish on mosquitoes. In other studies, the introduc-tion of mosquitofish increased the abundance of tion of mosquitons increased the abundance of mosquito larvae; indirect positive effects of the type demonstrated in this study could account for these results. (Author's abstract) W89-03124

RECENT ACIDIFICATION OF A LARGE SCOTTISH LOCH LOCATED PARTLY WITHIN A NATIONAL NATURE RESERVE AND SITE OF SPECIAL SCIENTIFIC INTEREST,

University Coll., London (England). Dept. of Geography. For primary bibliographic entry see Field 5C. W89-03125

RISING LEVEL OF THE GREAT SALT LAKE: IMPACTS AND ADJUSTMENTS,

National Center for Atmospheric Research, Boulder, CO. For primary bibliographic entry see Field 6F. W89-03127

RESPONSES OF FOUR IRISH WETLAND TREE SPECIES TO RAISED SOIL WATER LEVELS

Trinity Coll., Dublin (Ireland). School of Botany. New Phytologist NEPHAV, Vol. 109, No. 4, p 491-497, August 1988. 3 fig, 2 tab, 38 ref.

Descriptors: *Water level fluctuations, *Wetlands, *Trees, *Soil water, Oxidation-reduction potential, Soil saturation, Waterlogging, Ireland, Water

The four most common tree species in Irish wet-land woods are Alnus glutinosa (L.) Gaertn. (common alder), Betula pubescens Ehrh. (downy birch), Frasinus excelsior L. (ahs) and Salix cinerea ssp. oleifolia Macreight (Salix atrocinerea Brot., common sally). Seedlings of these species were subjected to different soil water levels (half saturat-ed and surface saturated) in their second and third years of growth, and performance was compared with that in a free draining control treatment. All plants survived in the water treatment, except for over 50% of the B. pubescens. Soil redox poten-tials indicated a gradient in the degree of hypoxia which seemed to reflect the order of tolerance of which seemed to reflect the order of tolerance of the species, as shown by measurements of relative growth and final dry weight. The observed differences in soil redox potentials may have been due to the oxidizing activity of the roots of tolerant species, which showed varying degrees of stem base hypertrophy and associated proliferation of lenticels. Species were affected by the waterlogging treatments in the order B. pubescens (most adversely affected) > A. glutinosa > F. excelsior > S. cinera ssp. oleifolia. (Author's abstract) W89-03128

RADIAL STEM GROWTH OF CONIFEROUS TREES NEAR SWEDISH RESERVOIRS,
Umea Univ. (Sweden). Dept. of Ecological

Botany. For primary bibliographic entry see Field 6G. W89-03142

TOTAL PHOSPHORUS BUDGET FOR LAKE

ST. CLAIR: 1975-80, National Oceanic and Atmospheric Administra-tion, Ann Arbor, MI. Great Lakes Environmental For primary bibliographic entry see Field 5B.

W89-03168

ROLE OF THE SEED BANK IN THE DEVEL-OPMENT OF VEGETATION ON A FRESHWA-TER MARSH CREATED FROM DREDGE

Ohio State Univ., Columbus. Environmental Biol-

Onio State Chin', Accounting the Company Program.
C. E. Siegley, R. E. J. Boerner, and J. M. Reutter.
Journal of Great Lakes Research JGLRDE, Vol.
14, No. 3, p 267-276, 1988. 1 fig. 4 tab. 36 ref. Ohio
Sea Grant Program NA84AA-D-00079.

Descriptors: *Seeds, *Vegetation establishment,
*Marshes, *Marsh plants, *Spoil banks, Great
Lakes, Spoil disposal, Plant populations, Dredging,

The contribution of the seed bank to the early seral flora of a wetland created in Sandusky Bay, Ohio, flora of a wetland created in Sandusky Bay, Ohio, using dredge spoil was evaluated by comparing results from greenhouse germination experiments with those from field surveys. Germinable seeds were patchily distributed both among and within the three dredge spoil-filled marsh areas and the unfilled control area. The unfilled had the most diverse seed bank (22 species), though not the densest (1,029 germinable seed/sq m of marsh bottom down to 10 cm). The seed banks of the spoil-filled areas averaged 13 species (range 7-15) and 980 germinable seeds/sq m (range 300-1,711). Total seed bank density was 1/6 to 1/20 of those of natural wetlands. Germination conditions were the Total seed bank density was 1/6 to 1/20 of those of natural wetlands. Germination conditions were the most important factor governing seedling emergence, with more germination occurring in mudflat conditions than submerged conditions. Approximately 18% of the total early seral flora and 28% of the early wetland species flora were represented in the seed bank, though again the proportions were higher in the unfilled control area than in the dredge-spoil filled cells. The seed bank and early seral floras differed little from species lists in historical records of the area. Many of the early seral species cited as important as wildlife or waterflow! torical records of the area. Many of the early seral species cited as important as wildlife or waterfowl food sources originated in the seed bank whereas the major pest species dispersed into the study site from outside the marsh. The above findings are useful for predicting vegetation dynamics of dredge-spoil wetlands suitable for waterfowl and other wildlife. (Author's abstract) W89-03169

EFFECT OF SUBMERSED AQUATIC MACRO-PHYTES ON RESOURCE PARTITIONING IN YEARLING ROCK BASS (AMBLOPLITES RU-PESTRIS) AND PUMPKINSEEDS (LEPOMIS GIBBOSUS) IN LAKE ST. CLAIR, National Fisheries Research Center-Great Lakes.

Ann Arbor, MI. J. R. P. French.

Journal of Great Lakes Research JGLRDE, Vol. 14, No. 3, p 291-300, 1988. 4 fig, 2 tab, 20 ref.

Descriptors: *Aquatic plants, *Macrophytes, *Vegetation effects, *Fish diets, Fish food orga-nisms, Fish behavior, Fish, Bass, Sunfish, Lakes,

Yearling rock bass (Ambloplites rupestris), pump-kinseeds (Lepomis gibbosus), macroinvertebrates, and submersed aquatic plants were sampled at 2week or 3-week intervals from June to October 1979 in a shallow, heavily vegetated embayment in 1979 in a shallow, nearlyl vegetated emosyment in Lake St. Clair to determine whether seasonal changes in plant canopy and plant taxonomic composition affected resource partitioning in these two fish species. In both species, numbers of prey and gut volumes increased with increasing plant canopy until the plant canopy reached a seasonal maximum in mid-summer. Rock bass consumed fewer, larger prey than pumpkinseeds while large Caenidae-Trichoptera-Coenagrionidae, the prey group most preferred by rock bass, was available. Pumpkinseeds ate smaller amphipods, gastropods, and chironomid-lepidopterans that were more abundant numerically than Caenidae-Trichoptera-Coenagrionidae. After mid-summer, the plant canopy declined slowly to one-half of the maximum value, but built-up densities of Hyallela azteca, gastropods, and chironomid-lepidopterans kept availability of prey high throughout late Lake St. Clair to determine whether seasonal

summer. Rock bass shifted to Gammarus, gastro-pods, and chironomid-lepidopterans as large Caeni-dae-Trichoptera-Coenagrionidae became scarce. dae-Trichoptera-Coenagrionidae became scarce. Pumpkinseeds ate more prey in the late season and displayed no prey preference. Their gut volumes peaked in September. Apparently, the increasing combined canopy of bushy plants and Heteranthera dubia hindered the foraging of rock bass more than that of pumpkinseeds and caused resource partitioning in the two species. (Author's abstract) W89-03171

INTERSTITIAL WATER QUALITY OF LAKE TROUT SPAWNING HABITAT, National Water Research Inst., Burlington (Ontar-

For primary bibliographic entry see Field 5C. W89-03172

HISTORICAL BASIS FOR LIMITS ON LAKE SUPERIOR WATER LEVEL REGULATIONS, National Oceanic and Atmospheric Administra-tion, Ann Arbor, MI. Great Lakes Environmental Research Lab.

For primary bibliographic entry see Field 4A. W89-03173

NONPARAMETRIC EVALUATION OF THE SIZE OF LIMNOLOGICAL SAMPLING NETWORKS: APPLICATION TO THE DESIGN OF A SURVEY OF GREEN BAY,
Argonne National Lab., IL. Biological, Environmental, and Medical Research Div.

For primary bibliographic entry see Field 7A. W89-03174

RELATIONSHIPS AMONG SECCHI DISK DEPTH, BEAM ATTENUATION COEFFI-CIENT, AND IRRADIANCE ATTENUATION COEFFICIENT FOR GREAT LAKES WATERS, National Water Research Inst., Burlington (Ontar-

National water Research Inst., Burington (Ontario). Rivers Research Branch.
R. P. Bukata, J. H. Jerome, and J. E. Bruton.
Journal of Great Lakes Research JGLRDE, Vol.
14, No. 3, p 347-355, 1988. 8 fig. 3 tab, 19 ref.

Descriptors: *Secchi disks, *Optical properties, *Opacity, *Light penetration, *Transparency, Mathematical analysis, Lakes, Data collections, Great Lakes

Optical data collected between 1973 and 1979 are utilized to discuss the relationships among the directly observed Secchi disk depths and the directly measured total attenuation coefficients and irradiance attenuation coefficients in Lakes Erie, Ontario, Superior, and Huron, as well as Georgian Bay.

Tables and curves are presented depicting these
mathematical relationships obtained by statistical
regressions. These relationships are used to effect regressions. These relationships are used to effect an intercomparison of the four Laurentian Great Lakes. In addition, subsurface, vertically downward sighting ranges are estimated and compared to the Secchi disk depths as determined from the mathematical regressions. Since there exists a vast amount of historical Secchi disk depth measurements, the need for such relationships certainly exist. It is intended that the cautious use of these regressions will assist the interpretation of such historical data bases wherein Secchi depths comprise the only available optical information. (Author's abstract) thor's abstract) W89-03176

DISTRIBUTION OF CONTAMINANTS IN CLAMS AND SEDIMENTS FROM THE HURON-ERIE CORRIDOR: II, LEAD AND

CADMIUM, Windsor Univ. (Ontario). Great Lakes Inst For primary bibliographic entry see Field 5B. W89-03177

NEW BIOLOGICAL MARKER LAYER IN THE SEDIMENTS OF THE GREAT LAKES; BYTH-OTHREPHES CEDERSTROEMI (SCHODLER)

National Oceanic and Atmospheric Administra-

tion, Ann Arbor, MI. Great Lakes Environmental Research Lab. T. J. Keilty

Journal of Great Lakes Research JGLRDE, Vol. 14, No. 3, p 369-371, 1988. 1 tab, 7 ref. NSF Grant OCE-86-14619.

Descriptors: *Paleolimnology, *Core logging, *Fluvial sediments, *Great Lakes, *Biological markers, *Marking techniques, Crustaceans, Bioindicators, Cladocera, Spines, Zooplankton, Lakes.

The European cladoceran, Bythothrephes ceder-The European chaoceran, Bythothrephes ceder-stroemi (Schodler), recently invaded the Lauren-tian Great Lakes. Based on recent zooplankton records, it most likely appeared first in 1984 in Lakes Ontario, Erie, and Huron, and in 1985 in Lake Michigan. It has yet to be reported from Lake Superior. This species is a relatively largebodied predatory form that possesses a long, caudal, laterally barbed spine. B. cederstroem spines and spine fragments were found in the upper fractions (predominantly 0-4 cm) of 35 sediment tractions (predominantly 0-4 cm) of 35 sediment cores collected from seven areas of deposition in the eastern basin of Lake Erie. All remains were well preserved and easy to identify. Very few to 0 spines were found in core depths greater than 4 cm suggesting that the invasion of this species has resulted in a new, readily distinguishable time horizon marker. (Author's abstract) W89-03178

OPERATIONS FOR AN UNDER-ICE ECOLO-

National Oceanic and Atmospheric Administra-tion, Ann Arbor, MI. Great Lakes Environmental Research Lab

S. J. Bolsenga, H. A. Vanderploeg, M. A. Quigley, and G. L. Fahnenstiel.

Journal of Great Lakes Research JGLRDE, Vol. 14, No. 3, p 372-376, 1988. 4 fig, 3 ref.

Descriptors: *Project planning, *Iced lakes, *Aquatic ecosystems, *Lake ice, *Light penetration, Population dynamics, Plankton, Ice cover, Great Lakes, Biological sample

A pilot program tested the feasibility of conduct-A pitot program tested the leasibility of conducting a study on the under-ice ecology of the Great Lakes. The east arm of Grand Traverse Bay, in the lower peninsula of Michigan, was chosen as the test area. The project was conducted in three phases; (1) a pre-ice cruise (open water); (2) an under-ice phase; and (3) a post-ice cruise (open water). Logistics problems were encountered in water). Logsitics problems were encountered in both operations and data collection. Significant experience was gained in both areas to make future programs of this type more efficient and scientifi-cally productive. Planning with attention to details and simplicity, adequate cold-weather gear, suffi-cient time to conduct the experiments under ad-wers a wasther conditions attention to safety equipcient time to conduct the experiments under adverse weather conditions, attention to safety equipment and operating procedures, and coordination of the various scientific phases are key items in the success of such programs. (Vernooy-PTT) W89-03179

COASTAL LAGOONS OF EAST ANGLIA, U.K., Cambridge Univ. (England). Dept. of Zoology. For primary bibliographic entry see Field 2L. W89-03184

PU(239,240) RESIDENCE TIMES IN FRESH-WATERS AND ACCUMULATION IN SHIELD LAKE SEDIMENTS,

Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
R. J. Cornett, and L. Chant.

Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 3, p 407-415, March 1988. 7 tab, 66 ref.

Descriptors: *Plutonium, *Pollutant identification, *Lake sediments, *Tracers, *Isotopic tracers, *Model studies, *Retention time, Chemical properties, Hydrologic properties, Flushing, Lakes, Oligotrophic lakes, Canadian shield, Heavy metals.

Group 2H-Lakes

Activity balances for Pu(239,240) in seven oligotrophic lakes were constructed from measurements of Pu(239,240) inputs and measurements of Pu(239,240) accumulated in lake sediments. Pu(239,240) eroded from the catchment was a significant input to lakes with rapid hydrologic flushing rates. From 28 to 100% of the Pu(239,240) input to the lakes accumulated in the lake sediments. The fraction of Pu(239,240) input accumulated in the lake sediments was inversely correlated with the hydrologic flushing rate of the lake Pu(239,240) concentrations in the sediments were simulated using a single reservoir input-output model. Partial residence times for Pu(239,240) transfer from the water to the sediments ranged from 0.09 to 2.7 years and were shorter in lakes with more rapid flushing. Partial residence times of Pu(239,240) in these small shield lakes were very similar to the residence times of Pu(239,240) in the Laurentian Great Lakes and to those of Cs(137) and Pb(210) in other small oligotrophic lakes. (Author's abstract) Activity balances for Pu(239,240) in seven oligothor's abstract) W89-03209

PREDICTION OF PHOSPHORUS RELEASE RATES FROM TOTAL AND REDUCTANT-SOLUBLE PHOSPHORUS IN ANOXIC LAKE

York Univ., Downsview (Ontario). Faculty of Sci-

G. K. Nurnberg. Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 3, p 453-462, March 1988. 8 fig. 6 tab, 60 ref.

Descriptors: *Phosphorus, *Lake sediments, *Lakes, *Sediment-water interfaces, *Limnology, *Cycling nutrients, Regression analysis, Chemical properties, Mathematical studies, Chemical reactions, Biological properties, Ecosystems.

Release rates of phosphorus from anoxic sediment surfaces in seven North American lakes were de-termined from core tube incubations. These rates termined from core tube includations. I nesse rates were compared with several P fractions within the 0-5 and 5-10 cm layers of the corresponding sediment. Regressions of release rates both on total sediment P and on reductant-soluble P were highly sediment P and on reductant-soluble P were highly significant. Analysis of literature data from lakes worldwide also showed significant relationships between the release rates and total sediment P and citrate dithionite bicarbonate extractable P. Mass balance calculations for individual cores indicated that reductant-soluble P decreases in wet surficial sediments, while total P in the overlying water increases. The release rates of different P fractions in the water (total, soluble reactive, and total reactive P) were very similar indicating the high brach tive P) were very similar, indicating the high bio-logical availability of the released P. (Author's abstract) W89-03210

HYDROLOGIC AND RIPARIAN INFLUENCES ON THE IMPORT AND STORAGE OF COARSE PARTICULATE ORGANIC MATTER

Kansas State Univ., Manhattan. Div. of Biology. M. E. Gurtz, G. R. Marzolf, K. T. Killingbeck, D. L. Smith, and J. V. McArthur.

Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 4, p 655-665, April 1988. 3 fig. 6 tab, 36 ref. Kansas Water Resources Research Institute Project B-063-KAN.

Descriptors: *Particulate matter, *Organic matter, *Vegetation effects, *Stream biota, *Riparian vegetation, Stream banks, Headwaters, Forest hydrology, Hydrological regimes, River continuum concept, Detritus.

The hydrologic regime and zonation of riparian vegetation influenced the quantity and quality of coarse particulate organic matter (CPOM; > 1 mm) stored in the channel and upper bank of a prairie stream. In a 5.4-km intermittent reach of the South Branch of Kings Creek on Konza Prairie, Kansas, total annual import was lowest in headwater reaches and increased downstream. Total storage of benthic CPOM in the dry channel and on the bank before the flow period was highest in the fourth- and fifth-order gallery forest zone (999 g

ash-free dry mass/sq m) and less in upstream reaches (320-341 g/sq m). These longitudinal patterns of CPOM annual import and storage (before the flow period) were opposite those predicted by the flow period) were opposite those predicted by the river continuum concept for streams draining forested regions. Following flow, headwater chan-nels had more CPOM (291 g/sq m) than down-stream reaches. On the bank, storage was always highest in downstream reaches. Composition of CPOM both in the channel and on the bank varied with changes in riparian vegetation; grass tissues dominated in headwater channels, while wood and leaves of trees and shrubs were more abundant downstream During the flow period, storage of leaves of trees and shrubs were more abundant downstream. During the flow period, storage of CPOM increased only in headwater channels, where retention was high despite the lack of woody debris. In this intermittent prairie stream, benthic CPOM may not contribute consistently to the terrestrial/aquatic linkages that are suggested in the river continuum concept because of (1) a paucity of large CPOM sources (e.g., trees, shrubs) in the upper reaches and (2) a hydrologic regime that reduces the amount, as well as the predictability, of stored CPOM. The biota of prairie streams must have opportunistic food gathering and repromy, or stored CFOM. The blood of prairie streams must have opportunistic food gathering and reproductive strategies to take advantage of variable food resources in a flow environment that is itself very unpredictable. (Author's abstract) W89-03214

PHOTOSYNTHETIC CARBON METABOLISM BY PHYTOPLANKTON IN A NITROGEN-LIM-ITED RESERVOIR,

NESERVUIR, Oklahoma Univ., Norman. Dept. of Zoology. A. W. Groeger, and B. L. Kimmel. Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 4, p 720-730, April 1988. 8 fig. 1 tab, 68 ref. DOE Contract DE-AC05-840R21400.

Descriptors: *Phytoplankton, *Metabolism, *Limnology, *Photosynthesis, *Carbon cycle, *Epilimnion, *Reservoirs, Chlorphyll, Normandy Lake, Limiting nutrients, Cycling nutrients, Nitrogen cycle, Tennessee, Aquatic plants, Enrichment, Deficient elements, Ecosystems.

Phytoplankton in the downlake epilimnion of Nor-Phytopiankton in the downlake epiimmion of Normandy Lake, a central Tennessee reservoir, responded to summer N deficiency by increasing relative rates of lipid synthesis from 10-15% up to 20-35% of the total photosynthetic C fixation. Phytopiankton in more N-sufficient areas of the reservoir (downlake in a metalimnetic chlorophyll peak and uplake page the river inflow) mointained lower and uplake page the river inflow) mointained lower voir (downlake in a metalimnetic chlorophyll peak and uplake near the river inflow) maintained lower rates of lipid synthesis, generally < or = 10% of the total fixed C, throughout the summer. NH4 enrichment of N-deficient phytoplankton inhibited photosynthesis and significantly depressed the high lipid synthesis rates; however, NH4 enrichment had no effect on the photosynthesis or lipid synthesis of N-sufficient phytoplankton. The results document, for the first time, the occurrence of high lipid synthesis rates associated with the N limits. lipid synthesis rates associated with the N limita-tion of natural phytoplankton assemblages. This relationship has previously been observed only in laboratory algal culture studies. (Author's abstract) W89-03215

EMERGENCE OF CHIRONOMIDAE (DIP-TERA) IN FERTILIZED AND NATURAL LAKES AT SAQVAQJUAC, N.W.T., Department of Fisheries and Oceans, Winnipeg

(Manitoba). Freshwater Inst.

(Manitoba). Freshwater Inst. H. E. Welch, J. K. Jorgenson, and M. F. Curtis. Canadian Journal of Fisheries and Aquatic Sci-ences CJFSDX, Vol. 45, No. 4, p 731-737, April 1988. 5 fig, 2 tab, 21 ref.

Descriptors: *Midges, *Phytoplankton, *Biomass, *Primary productivity, *Fertilization, Lakes, Aquatic productivity, Benthic flora, Equilibrium. Northwest Territories, Latitude, Canada.

Chironomid emergence was quantified in four small lakes at Saqvaqjuac, N.W.T. (63 degrees, 39 minutes N), before and after lake fertilization. Emerging biomass responded immediately to increased phytoplankton production, reaching equilibrium the following year. Emergence from the reference lake was extremely variable, for no ap-

parent reason. The emergence - phytoplankton production relationships found by Davies for the Experimental Lakes Area (about 49 degrees N) were generally valid for Saqvaqiuac lakes and Char Lake (74 degrees 42 minutes N), except that (1) biomass was better correlated than numbers because of increased mean size with increasing because of increased mean size with increasing latitude and (2) total primary production was a better predictor than phytoplankton production alone because benthic photosynthesis increases with increasing latitude. Chironomid production seems to be a predictable function of total primary production throughout the latitudinal range of the small Canadian lakes examined. (Author's abstract)

COMPARISON OF IN SITU ESTIMATES OF CHLOROPHYLL A OBTAINED WITH WHAT-MAN GF/F AND GF/C GLASS-FIBER FILTERS IN MESOTROPHIC TO HYPEREUTOPHIC LAKES.

Alberta Univ., Edmonton. Dept. of Zoology. For primary bibliographic entry see Field 7B. W89-03217

CONTRASTING PATTERNS OF NET- AND NANOPLANKTON PRODUCTION AND BIOMASS AMONG LAKES,

NALSS AMUNU LAKES, Calgary Univ. (Alberta). Aquatic Ecology Section. S. Watson, and E. McCauley. Canadian Journal of Fisheries and Aquatic Sci-ences CJFSDX, Vol. 45, No. 5, p 915-920, May 1988. 4 fig, 1 tab, 64 ref.

Descriptors: *Biomass, *Primary productivity, *Phytoplankton, *Limnology, *Phosphorus, *Lim-iting nutrients, Cell size, Lakes, Seasonal variation, Comparison studies, Algal growth, Eutrophica-tion, Enrichment, Comparison studies.

The relative contribution of nanoplankton to total algal biomass was shown to be negatively correlated with total phosphorus during summer over a wide range of lakes. It was hypothesized that this pattern can be explained either by changes in the relative growth rates of net- or nanoplankton with increased nutrient levels, or through the regulation of the nanoplankton biomass by herbivores, allowing disproportionate increases in netplankton biomass in more eutrophic systems. These explanations were tested by examining the relationships between net primary production (grams of carbon per cubic meter per year) and biomass (micrograms per liter) of these size fractions and total phosphorus concentrations (micrograms per liter) The relative contribution of nanoplankton to total grams per liter) of these size fractions and total phosphorus concentrations (micrograms per liter) using literature data from lakes throughout the world. The production of the net- and nanoplankton vary similarly with total phosphorus, while the biomasses (and thus the ratios of production to biomass) of the two groups show significantly different relationships. The results support the hypothesis that changes in the size distribution of summer phytoplankton with enrichment seem to be influenced more by herbivores than by changes in the relative growth rates of the two size fractions. (Author's abstract) tions. (Author's abstract) W89-03218

SILICA AND PHOSPHORUS FLUX FROM SEDIMENTS: IMPORTANCE OF INTERNAL RECYCLING IN LAKE MICHIGAN,

Michigan Univ., Ann Arbor. Great Lakes Research Div.

Scarich Div. D. J. Conley, M. A. Quigley, and C. L. Schelske. Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 6, p 1030-1035, June 1988, 3 fig, 2 tab, 29 ref. NSF Grant No. OCE-82-

Descriptors: *Silica, *Phosphorus, *Lake sediments, *Great Lakes, *Limnology, *Lake Michigan, *Cycling nutrients, Fluctuations, Primary productivity, Phytoplankton, Seasonal variations, Diatoms, Biogeochemistry, Water column.

Estimated lake-wide sediment fluxes of silica and phosphorus (P) were determined and then compared with other components in the biogeochemical cycle to investigate the importance of sediment

regeneration in Lake Michigan. Dissolved silica regeneration in Lake Michigan. Dissolved silica (Si) and soluble reactive phosphorus (SRP) fluxes from sediments were measured by the incubation of intact sediment cores. Estimated Si flux from sediment scan supply 21% of the total mass of silica in the water annually and 26% of the Si used during annual diatom production. By contrast, estimated SRP flux from lake sediments can supply only 4.1% of the mass of total P in the water annually and < 1% of the P utilized for annual primary production. Because the internal regeneraprimary production. Because the internal regenera-tion of P occurs rapidly in the water column, tion of P occurs rapidly in the water column, compared with the much slower regeneration of Si (0.8 /yr), P can be used many times during an annual cycle whereas Si is used only once. Thus, differences in the supply rates and in the biogeochemical recycling rates of Si and P can lead to seasonal Si depletion in the water mass and influence the outcome of seasonal phytoplankton species success by limiting Si availability necessary for diatom production. (Author's abstract) W89-03219

CONTRASTING DIEL PATTERNS OF VERTI-CAL MIGRATION IN THE DINOFLAGEL-LATE CERATIUM HIRUNDINELLA IN RELA-TION TO PHOSPHORUS SUPPLY IN A NORTH TEMPERATE RESERVOIR,

NORTH TEMPERALE RESERVOIR, Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab. W. D. Taylor, J. W. Barko, and W. F. James. Canadian Journal of Fisheries and Aquatic Sci-ences CJFSDX, Vol. 45, No. 6, p 1093-1098, June 1988. 5 fig, 16 ref.

Descriptors: *Dinoflagellates, *Ceratium, *Animal behavior, *Limnology, *Migration, *Oxic-anoxic interfaces, *Phosphorus, *Cycling nutrients, Aeration zone, Reservoirs, Photosynthesis, Animal populations, Ecosystems, Primary productivity.

Very different diel patterns of vertical migration in Very different one patterns of vertical migration in Ceratium hirundinella were observed during two midsummer periods of study in a north temperate reservoir. During the first study (29-30 July), Cera-tium migrated within a 2-m-deep oxygenated zone, moving upward to near the surface during the day moving upward to near the surface during the day and downward to the oxic-anoxic interface at night. During the second study (7-8 August), Ceratium did not migrate towards the surface during the day. High photosynthetic oxygen production and mixing processes increased oxygen distribution from 2 to 3 m providing Ceratium with access to a significantly greater water volume, with a greater nutrient content. Riverine phosphorus loading during the week prior to the first study was about 10 time greater than during the week prior to the second study. Limiting cell phosphorus concentrations and no measurable soluble reactive phosphorus in the upper (0-3 m) water column suggested a relationship between phosphorus limitation and the rus in the upper (u-3 m) water column suggested a relationship between phosphorus limitation and the cessation of positive phototaxis. Diel patterns of vertical migration in this species may be influenced by episodic variations in phosphorus and/or other nutrient loadings via riverine inputs as interflows to this reservoir. (Author's abstract) W89-03221

SEDIMENT RECORD OF BIOGEOCHEMICAL RESPONSES TO ANTHROPOGENIC PERTURBATIONS OF NUTRIENT CYCLES IN LAKE ONTARIO, Michigan Univ., Ann Arbor. Great Lakes Re-

Michigan Univ., Ann Arbor. Great Lakes Research Div. C. L. Schelske, J. A. Robbins, W. S. Gardner, D. J. Conley, and R. A. Bourbonniere. Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 7, p 1291-1303, July 1988. 12 fig, 1 tab, 46 ref.

Descriptors: *Lake dating, *Phosphorus, *Biogeochemistry, *Cycling nutrients, *Simulation analysis, Simulation, Eutrophication, Diatoms, Silica, Primary productivity, Fluctuations, Paleolimnology, Nutients, Organic matter, Photosynthesis, Phytoplankton.

Two sediment cores collected from the Rochester basin of Lake Ontario were dated with Pb(210) and stratigraphic correlation and analyzed to determine whether nutrient accumulation with time was con-

sistent with previous computer-simulated total phosphorus (TP) loadings. Relative increases in TP and nonapatite inorganic phosphorus (NAIP) accumulation were less than the fivefold increase in TP loading from 1800 to 1950 predicted independently from Chapra's simulation model. In addition, increases in TP accumulation occurred mainly after 1940 and the proportion of NAIP relative to TP increased in one core and decreased in the other. Of the nutrients studied, only increases in modelled TP loadings. The relative increase in morganic carbon (IC) was greatest, with accumulation increasing an order of magnitude after 1940 in one core. This large increase in IC, amounting to 20% calcite in recent sediments, was attributed to biologically induced calcite precipitation, a secondary calcite in recent sediments, was attributed to bio-logically induced calcite precipitation, a secondary consequence of increased planktonic photosynthet-ic removal of carbon dioxide that resulted from ic removal of carbon dioxide that resulted from accelerated eutrophication after 1940 when modelled TP concentrations increased rapidly. Biogenic silica (BSi) accumulation, an indicator of increased diatom production, peaked between 1850 and 1870 when increases in TP and NAIP fluxes were minimal. Results provide evidence that historic biogeochemical responses inferred from OC, IC, and BSi accumulation in the sediment record provide stronger signals of phosphorus enrichment effects than can be inferred directly from changes in accumulation of different forms of phosphorus in the sediment record. (Author's abstract) W89-03222

CORRESPONDENCE BETWEEN EC GIONS AND SPATIAL PATTERNS STREAM ECOSYSTEMS IN OREGON,

Northrop Services, Inc., Corvallis, OR.
T. R. Whittier, R. M. Hughes, and D. P. Larsen.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 7, p 1264-1278, July 1988. 9 fig, 6 tab, 53 ref. EPA Contract 68-03-3124.

Descriptors: *Ecosystems, *Physiochemical prop-Descriptors: "Provident and in a species diversity, Regime streams, Aquatic habitats, Regional analysis, Water quality, Fish populations, Macroinvertebrates, Ecoregions, Periphyton, Watershed man-

Multivariate analyses of biotic assemblages an physochemical measures, species richness, diversity, and composition were used to evaluate the robustness of Mernik's ecoregion classification for small ness of Mernik's ecoregion classification for small streams in the eight ecoregions of Oregon. Clearest differences were between the montane and nonmontane regions. For the three nonmontane regions, ordinations of fishes, macroinvertebrates, water quality, and physical habitat measures show the clearest differences, with the Willamette Valley ecoregion being consistently most unlike all other regions. Differences between the Columbia Basin and High Desert regions were clearest for water quality and physical habitat measures and fish assemblages. Differences among the montane regions were subtle. Of these regions, the East Cascade Slopes showed the greatest variability, as shown by the ranges of ordination scores for fishes, Cascade Slopes showed the greatest variability, as shown by the ranges of ordination scores for fishes, water quality, and physical habitat. Regional patterns in periphyton assemblages were markedly different from the patterns in the other groups of variables. Ecoregions can be used as a broad-scale geographic framework for classifying steams. This framework provides managers of lotic resources a useful alternative to river basins. (Author's abstract) W89-03223

EFFECTS OF LIMING ON THE DISTRIBU-TION OF CADMIUM IN WATER, SEDIMENT, AND ORGANISMS IN A SWEDISH LAKE,

National Swedish Environment Protection Board, Solna. Trace Metal Lab. For primary bibliographic entry see Field 5B. W89-03224

SCALED CHRYSOPHYTES (CHRYSOPHY-CEAE) AS INDICATORS OF PH IN SUDBURY,

ONTARIO, LAKES,
Trent Univ., Peterborough (Ontario). Trent
Aquatic Research Centre.

For primary bibliographic entry see Field 5A. W89-03227

LITTORAL ZOOBENTHIC BIOMASS IN LAKES, AND ITS RELATIONSHIP TO PHYSI-CAL, CHEMICAL, AND TROPHIC FACTORS, McGill Univ., Montreal (Quebec). Dept. of Biol-

Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 8, p 1436-1447, August 1988. 5 fig, 7 tab, 83 ref.

Descriptors: *Lake morphometry, *Ecosystems, *Biomass, *Benthic fauna, *Limnology, *Littoral environment, *Physicochemical properties, Mathematical studies, Lakes, Trace elements, Particulate matter, Deltas, Regression analysis, Lake Memphremagog, Water analysis, Chlorophyll, Trophic

The hypothesis that littoral morphometry exerts a strong effect on zoobenthic biomass was tested in Lake Memphremagog, Quebec-Vermont, by regression analysis of the relationship between littoral zoobenthic biomass and littoral slope, exposure (lake area visible from sampling site), and trophic status (micrograms of chlorophyll a per litre). Eighty-one percent of the variance in log littoral zoobenthic biomass (LZB) could be explained by the equation log LZB = 1.3069 + 0.6587 Log Chlorophyll (micrograms/L) - 0.0795 Exposure times Slope ((km squared) to the 0.25 power times (percent) to the 0.5 power). When the predictions from this relationship were compared with littoral zoobenthos estimates from other lakes, residuals were positively correlated with the calcium concentration of the water (r = 0.41) and negatively correlated with the chloride concentration (r = 0.51). The regression equation obtained for all of the sites was log LZB = 1.0940 + 0.3511 log chlorophyll - 0.1632 log slope - 0.518 Exposure times Slope + 0.4416 Log calcium (mg/L) - 0.2822 log chloride (mg/L) and explained 80% of the variation in log LZB. Sites situated within deltas from stream inflows did not differ significantly from these that did not (ANCOVA), indicating that coarse allochthonous input from these fluvial sources was not a major factor determining littoral zoobenthic biomass in these lakes. (Author's abstract) The hypothesis that littoral morphometry exerts a stract) W89-03229

DYNAMICS OF LAKE MICHIGAN PHYTO-PLANKTON: RELATIONSHIP TO NITROGEN AND SILICA FLUXES, National Oceanic and Atmospheric Administra-tion, Ann Arbor, MI. Great Lakes Environmental Research Lab.

G. W. Laird, D. Scavia, G. L. Fahnenstiel, L. A.

G. W. Laird, G. A. Lang. Strong, and G. A. Lang. Canadian Journal of Fisheries and Aquatic Sciences CIFSDX, Vol. 45, No. 8, p 1459-1466, August 1988. 8 fig, 1 tab, 43 ref.

Descriptors: *Nitrogen, *Silica, *Great Lakes, *Lake Michigan, *Limnology, *Phytoplankton, *Primary productivity, *Cycling nutrients, Chemical properties, Epilimnion, Diatoms, Biogeochemical properties, Lakes.

Rates of nitrogen and silica concentration change during May-August 1983 and 1984 in southeastern Lake Michigan are described, and are compared Lake Michigan are described, and are compared with measured plankton processes. Epilimnetic dissolved inorganic nitrogen depletion, compared with total phytoplankton demand, suggests that about 44% of the nitrogen demand is recycled. Epilimnetic diatom production, calculated from soluble stilica depletion, is a relatively small fraction (<20%) of total primary production, even when diatoms dominate. Sedimentation of epilimmetic diatom silica, compared with total silica de-pletion, suggests that a large portion (approximate-ty 43%) of epilimnetic particulate silica sedimenta-tion is due to nonliving diatoms. (Author's abstract) W89-03230

Group 2H-Lakes

INFLUENCE OF NUTRIENT ENRICHMENT AND LIGHT AVAILABILITY ON THE ABUNDANCE OF AQUATIC MACROPHYTES IN FLORIDA STREAMS, Florida Univ., Gainesville. Dept. of Fisheries and

Aquaculture.
For primary bibliographic entry see Field 5C.
W89-03231

COMPARISON OF PHOSPHORUS DYNAM-ICS IN TWO OKLAHOMA RESERVOIRS AND A NATURAL LAKE VARYING IN ABIOGENIC TURBIDITY, Kent State Univ., OH. Dept. of Biological Sci-

ences. R. T. Heath, and D. A. Francko. Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 8, p 1480-1486, August 1988. 2 fig, 3 tab, 37 ref. NSF Grant BSR 8214577.

Descriptors: *Silting, *Phosphates, *Water pollution effects, Farm runoff, *Seasonal variation, *Reservoirs, *Lakes, Phytoplankton, Primary productivity, Dynamics, Lake sediments, Comparison studies, Cycling nutrients, Path of pollutants, Epilimion, Biota, Productivity.

The rate of phosphate uptake, the immediate fate of phosphate, and the potential rate of release of phosphate from dissolved phosphorus compounds in epilimnia of two reservoirs and one natural lake in northcentral Oklahoma were compared in the summer and in the late autumn. Sangre Isle Lake is a highly productive eutrophic impoundment, San-born Lake is a natural lake with low phytoplankangmy productive eutropnic impoundment, San-born Lake is a natural lake with low phytoplank-tonic productivity, and Boomer Lake is an im-poundment with modest productivity that is heavi-ly affected by clay suspensoids. Although the uptake of phosphate (radiometrically determined) was rapid in each of these lakes in summer, the fate of phosphate in Boomer Lake differed from that of others, with much of the phosphate sorbing to suspended silts and clays rather than biota (deter-mined by isopycnic sedimentation). Recycling of phosphate from phosphomonoesters was greatest in Sangre Isle Lake, moderate in Sanborn Lake, but was undetectable in Boomer Lake. These find-ings suggest that high concentrations of clay su-spensoids influence the epilimnetic P dynamics in reservoirs and lakes. (Author's abstract) W89-03232

GROWTH AND PHOSPHOROUS STATUS OF LIMNETIC PHYTOPLANKTON AND BACTE-

Trondheim Univ. (Norway). Lab. of Biotechnol-

ogy. O. Vadstein, A. Jensen, Y. Olsen, and H. Reinertsen.

Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 1, p 489-503, July 1988. 8 fig, 4 tab, 75

Descriptors: *Bacteria, *Phytoplankton, *Growth, *Phosphorus, *Lakes, *Limnology, *Eutrophic lakes, *Limiting nutrients, Model studies, Droop

The phosphorous status (total phosphorus, surplus phosphorus, and alkaline phosphatase activity (APA)) of phytoplankton and bacteria were followed in an eutrophic Norwegian lake. On average, 36% (range 20-60) of the particulate phosphorus and 57% (range 10-100) of the surplus phosphorus were bound by bacteria. The P:C ratio of phytoplankton and bacteria varied between 2.5 and 55 (median 5.1) and 34 and 260 (median 89) microgrous phosphorus/mg carbon, indicating that bacteria have a substantially higher phosphorus requirement than do phytoplankton. The inverse relationship found between surplus P:C and APA:C ratios during a Microcystis aeruginosa bloom and the positive relation between P:C ratio and growth rate of the cryptophyte-dominated community in The phosphorous status (total phosphorus, surplus the positive relation between P-C ratio and growth rate of the cryptophyte-dominated community in summer indicate that the phytoplankton were phosphorus limited during most of the ice-free period. This is supported by the fact that the data from the cryptophyte-dominated community could be described by the Droop model for nutrient-limited growth. For the bacteria, a positive relation

was found between growth rate and cellular phos-phorus as predicted by the Droop model. Al-though the bacteria obviously were phosphorus though the bacteria obviously were phosphorus subsaturated, it cannot be concluded that they were phosphorus limited since carbon may have been supplied at an even lower rate. Because of their high phosphorus requirements, the bacteria acted as consumers of inorganic phosphorus and their net consumption of phosphorus was four times higher than that of the phytoplankton. (Author's abstract) W89-03244

MICROFLAGELLATE-PICOPLANKTON FOOD LINKAGE IN THE WATER COLUMN OF LAKE BIWA,

Kyoto Univ., Otsu (Japan). Otsu Hydrobiological Station.

1. Nagata. Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 1, p 504-517, July 1988. 5 fig. 4 tab, 38 ref. Ministry of Education, Science and Culture (Japan) Grant 61790227.

Descriptors: *Flagellates, *Plankton, *Limnology, *Seasonal variation, *Japan, *Biomass, *Lakes, *Food chains, Cyanophyta, Lake Biwa, Bacteria,

Seasonal variations of abundance and biomass of Seasonal variations of abundance and blomass of heterotrophic microflagellates, bacteria and unicellular chroococcoid cyanobacteria at a pelagic site (water depth was approximately 72 m), in the north basin of Lake Biwa (Japan), were measured from May to November 1984. The cell densities of heterotrophic microflagellates, bacteria and unicellular chroococcoid cyanobacteria were 100-1000, 1,000,000 and 100-100,000 cell/ml and the biomass 1,000,000 and 100-100,000 cell/ml and the biomass estimates were <1-7, 10-70, and <1-20 microg C / liter. Active phagocytosis of unicellular chroococcoid cyanobacteria by heterotrophic microflagellates was indicated from microscopic observation of heterotrophic microflagellates food vacuoles; when unicellular chroococcoid cyanobacteria density was high, up to 52% of heterotrophic microflagellates cells contained one or more unicellular chroococcoid cyanobacteria cells. Incubation of size/fractionated entilliments waters indicated that size-fractionated epilimnetic waters indicated that bacterial net production rates (5-25 microg C/liter-d) were usually almost equal to rates of consump-tion of bacteria by heterotrophic microflagellate tion of bacteria by heterotrophic microflagellate populations. Estimates of gross growth efficiencies of heterotrophic microflagellates fed on natural picoplankton were 11-53% in terms of carbon. Heterotrophic microflagellates may be a significant link transferring picoplankton energy to macrozoplankters which cannot collect picoplankton. Lack of information on the fate of heterotrophic microof information on the late of neterotrophic micro-flagellates makes it difficult, however, to directly address the 'sink vs. link' argument about the mi-crobial loop in Lake Biwa. (Author's abstract) W89-03245

EFFECT OF PH ON IRON AND MANGANESE UPTAKE BY A GREEN ALGA, Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).

For primary bibliographic entry see Field 5C. W89-03246

BIOGENIC GASES AND THE OXIDATION AND REDUCTION OF CARBON IN AMAZON RIVER AND FLOODPLAIN WATERS,

Washington Univ., Seattle. School of Oceanogra-

phy. For primary bibliographic entry see Field 2E. W89-03247

PHOSPHOROUS FLUX FROM LAKE SEDI-MENTS: EFFECT OF EPIPELIC ALGAL OXYGEN PRODUCTION,

OXYGEN PRODUCTION, Michigan State Univ. Hickory Corners. W.K. Kellogg Biological Station. R. G. Carlton, and R. G. Wetzel. Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 1, p 562-570, July 1988. 8 fig, 32 ref. DOE Grants DE-AC02-79EV01599, C00-1599-294 and NSF Grant BSR 84-07078.

Descriptors: *Limnology, *Phosphorus, *Lake sediments, *Lakes, *Euphotic zone, *Algae, *Cycling nutrients, Microorganisms, Oxygen, Fluctua-

The effect of epipelic algal photosynthesis on sediment oxygen dynamics and the concomitant pattern of phosphorus release from lake sediments were examined using oxygen-sensitive microelectrodes, 32PO(-3) radiotracer and a novel flowtrough, 32PQ-3) ranotracer and a novel now-through system. Epipelic algae mediated release of phosphorus from sediments to overlying water via daily formation and breakdown of the oxidized microzone. During illumination, surficial sediments microzone. During illumination, surficial sediments rapidly became oxygenated, and release of phosphorus diffusing from deeper sediment layers was inhibited. During darkness, the microzone became anoxic, and phosphorus was released to overlying water at an accelerated rate, producing marked diel fluctuation in efflux rate. Observed patterns of release are consistent with recent evidence for a mechanism consisting of rapid uptake or release of dissolved phosphate by sediment microorganisms in response to respective oxic or anoxic conditions. (Author's abstract)

METHANE CYCLING IN THE SEDIMENTS OF LAKE WASHINGTON,

Washington Univ., Seattle. School of Oceanogra-

phy.
K. M. Kuivila, J. W. Murray, A. H. Devol, M. E.
Lidstrom, and C. E. Reimers.
Limnology and Oceanography LIOCAH, Vol. 33,
No. 4, Part 1, p 571-581, July 1988. 6 fig, 1 tab, 40
ref. NSF Grants OCE 84-16258, OCE 83-08653,
OCE 83-15206 and NASA Grant NAGW 839.

Descriptors: *Methane, *Limnology, *Lake sediments, *Lake Washington, *Oxidation, *Fluctuations, *Carbon cycle, *Cycling nutrients, *Washington, Gases, Lakes.

The importance and ultimate fate of methane in the carbon cycle of Lake Washington was examined. Aerobic oxidation is important in the cycling of methane in the sediments. About half of the methane flux from depth is oxidized to CO2 in the upper 0.7 cm of the sediments and the remainder escapes into the water column. In terms of the total carbon budget of the lake, the unward flux of escapes into the water column. In terms of the total carbon budget of the lake, the upward flux of methane is insignificant with only about 2% of the carbon fixed by primary production being returned as methane. The upward flux of methane, however, does represent about 20% of the organic carbon decomposed within the sediments. In addition, methane oxidation consumes 7-10% of the total methane oxidation consumes 7-10% of the total oxygen flux into the sediments. Measured kinetic parameters suggest that methane oxidation is re-stricted to the top 6-7 mm of sediment where oxygen is present and that the rate this process is probably controlled by the concentration of meth-ane. (Author's abstract) W89-03249

SECONDARY PRODUCTION AND TROPHIC RELATIONSHIPS IN A SPRING INVERTE-BRATE COMMUNITY, Copenhagen Univ., Hilleroed (Denmark). Det Ferskvands-Biologiske Lab.

T. M. Iversen.

Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 1, p 582-592, July 1988. 4 fig, 9 tab, 42

Descriptors: *Springs, *Invertebrates, *Secondary productivity, *Trophic level, *Litter, Beech trees, Streams, Seasonal variation, Biomass.

The invertebrate fauna of a shaded area of the Danish spring Rold Kilde was sampled for a year. There was a large input of allochthonous beech litter, and the water trickled between waterlogged beech leaves. Discharge was constant and temperature amplitudes were small. Primary consumer biomass and production were 3.24 g AFDM/sq m and 8.65 g AFDM/sq m/yr and were dominated by shredders (70 and 69%) and gathering collectors (29 and 30%). The seasonal variation in shredder biomass and production was considerably larger nass and production was considerably larger

Lakes-Group 2H

within each shredder species than within the total shredder population, implying a relatively uniform processing of energy during the year. The shredder community processes about half of the total der community processes about half of the total leaf input. The primary consumer P.B was as low as 2.67/year due to many species with long life cycles. Average P.B for eight univoltine species and five semivoltine species was as low as 3.6 and 2.3/year mainly due to low rates of elimination. Invertebrate biomass and production in low-order streams were compared, and it was concluded that streams with a shading canopy have a significantly lower mean biomass, production, and P.B ratio than streams of similar order with reduced or no canopy. (Author's abstract)

MEASURING WATER CLARITY WITH A BLACK DISK, Ministry of Works and Development, Hamilton (New Zealand). Water Quality Centre. For primary bibliographic entry see Field 7B. W89-03251

NITROGEN FIXATION IN FRESHWATER, ES-TUARINE, AND MARINE ECOSYSTEMS: 1.
RATES AND IMPORTANCE,
Cornell Univ., Ithaca, NY. Section of Ecology and

R. W. Howarth, R. Marino, J. Lane, and J. J. Cole. R. W. Flowartin, R. Marino, J. Lane, and J. J. Cole Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 669-687, July 1988. 5 tab, 148 ref. NSF Grants BSR 83-051768, BSR 85-44552, and BSR 86-04688.

Descriptors: *Reviews, *Cycling nutrients, *Lim-nology, *Estuarine environment, *Nitrogen fixa-tion, *Aquatic environment, *Lake sediments, Lakes, Estuaries, Coastal waters, Eutrophication, Marine environment.

Data on nitrogen fixation rates for a variety of aquatic ecosystems were compiled and related to the nitrogen economy of the ecosystems. No data on planktonic nitrogen fixation in estuaries or coastal seas was found except for the Baltic Sea and for Peel-Harvey estuary in Western Australia. Fixation rates are quite high in the Peel-Harvey estuary; rates are low offshore in Baltic waters but can be high near shore. As in lakes, fixation in these systems is associated with major blooms of planktonic, heteroevcitic evanobacteria. The implanktonic, heteroevcitic evanobacteria. planktonic, heterocyctic cyanobacteria. The importance of nitrogen fixation to the nitrogen commy of aquatic ecosystems is quite variable. For example, fixation by planktonic organisms appears omy of aquate ecosystems is quite variable. For example, fixation by planktonic organisms appears unimportant as a nitrogen source to most oligotrophic and mesotrophic lakes, but accounts for 6-82% of the nitrogen inputs to eutrophic lakes. Planktonic fixation provides < 1% of the nitrogen inputs to surface waters of the world's oceans and is probably also of little importance in most estuaries, including eutrophic estuaries. However, planktonic fixation provides > 20% of the nitrogen input to the Asko region of the Baltic Sea and 17% of the nitrogen input to the Peel-Harvey estuary in Australia. Fixation in sediments of estuaries and eutrophic and mesotrophic lakes usually constitutes a small percentage of the nitrogen inputs to these systems. However, benthic fixation appears to be a major source of nitrogen fixation probably is a fairly minor input of nitrogen fixation probably is a fairly minor input of nitrogen to marine wetlands, which are generally open to other inputs, but contributes roughly all the total nitrogen input to other freshwater. of nitrogen to marine wetlands, which are generally open to other inputs, but contributes roughly
half the total nitrogen input to some freshwater
wetlands (bogs, cypress, domes) where other
inputs are more limited. Nitrogen fixation appears
important in making up deficits in nitrogen availability in many lakes, contributing to the phosphorus-limited status of these low rates of nitrogen
fixation found in these systems. (See also W8903255) (Miller-PTT)
W89-03254

NITROGEN FIXATION IN FRESHWATER, ESTUARINE, AND MARINE ECOSYSTEMS: 2. BIOGEOCHEMICAL CONTROLS, Cornell Univ., Ithaca, NY. Section of Ecology and

Systematics. R. W. Howarth, R. Marino, and J. J. Cole. Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 688-701, July 1988. 3 fig. 3 tab, 95 ref. NSF Grants BSR 83-05176, BSR 85-44552, and

Descriptors: *Reviews, *Cycling nutrients, *Lim-nology, *Aquatic ecosystems, *Estuarine environ-ment, *Aquatic environment, *Nitrogen fixation, *Nitrogen-fixing bacteria, Marine environment, Geochemistry, Biochemistry.

Geochemistry, Biochemistry.

A review of the regulation of nitrogen fixation rates by biogeochemical controls in natural waters and the interaction of these biogeochemical controls with physical factors is presented. In general, the controls by macroelements are better known than are the controls by microelements, and many of the observed differences in nitrogen-fixation rates among different lakes can be explained on the basis of these macroelemental controls. Nitrogen fixation is clearly greater in lakes where the N:P ratio of nutrient inputs is low; alterations in N:P concentration ratios during nutrient recycling within lakes can clearly affect nitrogen fixation; high concentrations of ammonium and nitrate can inhibit nitrogen fixation; and fixation of favored by low oxygen concentrations. The regulation of nitrogen fixation by availabilities of microelements (such as iron, molybdenum, and vanadium) is less well known, but it is suspected that differences in the availabilities of these microelements may explain why nitrogen fixation tends to be lower in estuaries and coastal seas than in lakes under conditions where macroelemental factors are similar. (See also W89-03254) (Miller-PTT)

DENITRIFICATION IN FRESHWATER AND COASTAL MARINE ECOSYSTEMS: ECOLOGI-CAL AND GEOCHEMICAL SIGNIFICANCE, Academy of Natural Sciences of Philadelphia, PA.
Div. of Environmental Research.

S. P. Seitzinger.
Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 702-724, July 1988. 2 fig, 8 tab, 118

Descriptors: *Marine environment, *Geochemistry, *Reviews, *Cycling nutrients, *Limnology, *Denitrification, *Lake sediments, *Lakes, *Coastal waters, *Estuaries, Sediments, Ecosystems, Marine sediments, *Aquatic ecosystems.

The rates of denitrification reported for streams and rivers, lakes, and subtidal coastal marine ecosystems are discussed and compared. The magnitude of denitrification is then compared to other nitrogen processes in those ecosystems, including nitrogen mineralization rates in the sediments, N2fixation rates and external nitrogen inputs to those systems. The effect of denitrification on the N:P ratio in those systems and the factors controlling denitrification rates are also discussed. Few major differences between denitrification in freshwater and marine ecosystems are apparent based on available data. The range of denitrification rates are reported for freshwater and coastal marine ecosystems in similar, although most of the lake denitrification rates fall in the low end of the range for river and coastal marine areas. Nitrification in the sediments is the major source of nitrate denitrification in most aquatic sediments studied. A dentifrification in most aquatic sediments studied. A large percentage of the organic nitrogen mineralized in rivers, lakes, and coastal marine sediments is denitrified; data available for freshwater sediments indicate that 75-100% of the benthic N efflux is N2 while in coastal marine sediments generally 20-75% of the benthos N efflux is N2. In studies the denitrification rates escentilly increasely incr generally 20-30 of the obtained Nethinks Nethinks Nethinks and the setuaries, denitrification rates generally increase as a linear function of the inorganic nitrogen loading rates with nitrification removing an amount of nitrogen equivalent to 40-50% of the DIN inputs. The relationship between denitrification rates The relationship between denitrification rates and nitrogen loading rates in streams, rivers and lakes is not consistent. The loss of fixed nitrogen via denitrification exceeds the input of fixed nitrogen via N2 fixation on all the rivers and estuaries, and in all but one lake, where measurements of both processes have been made. (Miller-PTT) W89-03256

COMPARISON OF MICROBIAL DYNAMICS IN MARINE AND FRESHWATER SEDI-MENTS: CONTRASTS IN ANAEROBIC CARBON CATABOLISM, ANAEROBIC

State Univ. of New York at Stony Brook. Marine Sciences Research Center.

Sciences Research Center.
D. G. Capone, and R. P. Kiene.
Limnology and Oceanography LIOCAH, Vol. 33,
No. 4, Part 2, p 725-749, July 1988. 2 fig. 11 tab,
219 ref. NOAA Grant NA-85-AA DSG-021, NSF
Grants OCE 84-17595, OCE 85-16604, and OCE
85-15886, EPA Grant R80-9475-01-0, and Hudson
River Foundation Grants 14-83B-12 and 16-85B-6.

Descriptors: *Marine sediments, *Reviews, *Lake sediments, *Microbiological studies, *Aquatic ecosystems, Organic carbon, Sulfates, Ecology, Sediments, Comparison studies, Organic matter, Lakes.

Information gathered on the microbial ecology of Information gathered on the microbial ecology of freshwater and marine sediments is reviewed with apparent similarities and differences noted. The microbiota of freshwater and marine sediments serve similar roles in carbon degradation and nutri-ent regeneration. However, because of differences in the chemical environment between freshwater in the chemical environment between freshwater and marine systems, distinct physiological groups of bacteria dominate terminal carbon catabolism in each system. In general, the distribution and rates of microbial activities within a sediment are determined by availability of electron acceptors for respiration and metabolizable organic substrates. Sulfate ion is a primary factor in the distribution of microbial activities in anoxic sediments. At the high sulfate concentration found in seawater, sulfate reduction exceeds methanogenesis and is rehigh sulfate concentration found in seawater, sul-fate reduction exceeds methanogenesis and is re-sponsible for most of the organic carbon oxidation. The importance of methanogenesis in sediment me-tabolism increases as salinity and, hence, sulfate decreases. In freshwaters, methanogenesis is re-sponsible for the bulk of terminal metabolism under anoxic conditions. The sources of organic matter to marine and freshwater sediments can be qualitatively different and it is likely that these difference also result in distinct assemblages of microorganisms responsible for the breakdown of organic carbon. The quantity of organic matter organic carbon. The quantity of organic matter present in the sediments is also a major factor determining the magnitude of various microbial activities. Near the extremes of high and low oractivities. Near the extremes of high and low organic loading, organic matter input may play a greater role than sulfate concentration in determining the relative importance of sulfate reduction or methanogenesis. In marine systems, methanogenesis occurs in the presence of sulfate ion, but only at the expense of substrates not used by sulfate reducers, such as methylamines and methylated reduced sulfur compounds. (Miller-PTT)
W89-03257

COMPARISON OF THE ECOLOGY OF PLANKTONIC BACTERIA IN FRESH AND SALT WATER.

Marine Biological Lab., Woods Hole, MA. Eco-systems Center. J. E. Hobbie.

Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 750-764, July 1988. 4 fig, 1 tab, 61

Descriptors: *Reviews, *Bacteria, *Plankton, *Seawater, *Aquatic environment, Ecosystems, Comparison studies.

The differences and similarities between the ecology of planktonic bacteria in fresh and salt water are reviewed. The planktonic bacteria inhabiting are reviewed. The plantonic dicteria innationing fresh and salt waters are not physiologically identical; most marine bacteria, for example, require sodium and some marine forms can thrive at 1,000 atm of pressure in the deep sea. Despite this difference, the conclusions of the review is that the ecology of plantonic bacteria is virtually identical in fresh and salt waters. The differences are small in fresh and salt waters. The differences are small and mostly a matter of relative proportion of various processes. That is, similar bacterial processes occur in fresh and salt waters but in each environment, one process may be more important than another. For example, bacteria in freshwaters are exposed to high amounts of refractory dissolved organic carbon from soil and stream runoff, while

Group 2H—Lakes

many marine bacteria are exposed to relatively more of the labile organic matter from decaying algae. Also, under anaerobic conditions, the sulfur cycle will be dominant in the sea while the carbon-methane cycle will be more important in fresh-waters. In spite of the presence of relatively high amounts of methane in the sea, there is thus far little evidence that a significant amount of methane if being oxidized. Not enough is yet known to determine if there are differences in the grazing of bacteria in the two systems. Small, flagellated protozoans are very important grazers in freshwater and marine systems but there is some evidence from salt waters that ciliates are also important grazers. Marine ecosystems also contain large animals that can filter out bacteria. Sponges are the mals that can filter out bacteria. Sponges are the dominant suspension feeders on coral reefs, mussels dominant suspension feeders on coral reefs, mussels and oysters are dominant in the estuarine and marsh systems, and a large appendicularian may filter significant amounts of bacteria through a mucous net. Ecological understanding of the aquatic bacteria has advanced rapidly in the past two decades. One reason is the basic similarity between microbial ecology in fresh and salt waters and the consequent interchangeability of techniques. (Author's abstract)

PHOTOTROPHIC PICOPLANKTON: AN OVERVIEW FROM MARINE AND FRESHWA-

TER ECOSYSTEMS,
Department of Fisheries and Oceans, Vancouver (British Columbia). West Vancouver Lab.

Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 765-775, July 1988. 4 fig, 3 tab, 99

Descriptors: "Plankton, "Bacteria, "Ecosystems, "Marine environment, "Reviews, "Picoplankton, 'Aquatic ecosystems, "Reviewa, "Picoplankton, 'Algae, Physiological ecology, Lakes, Food

A general overview of key findings from the litera A general overview of key findings from the literature, most notably those pertaining to the discovery, taxonomy, physiology, and ecology of algal picoplankton (particularly photoautotrophic) in both marine and freshwater systems is provided. Algal picoplankton are a ubiquitous component of the microbial plankton communities of both marine and freshwater ecosystems. They contribute to the total biomass of phytoplankton communities, and in oligotrophic oceans and lakes can be responsible for up to 80-90% of the total daily or annual carbon production. As part of the "microbial loop". for up to 80-90% of the total daily or annual carbon production. As part of the "microbial loop', they are thought to be grazed by flagellates, ciliates, rotifers, copepods, and other metazoans, and contribute to the flow of energy to higher trophic levels. Their discovery, distribution, physiology, production, and contribution to pelagic food webs in marine and freshwater systems are highlighted. (Miller-PTT) W89-03259

COMPARATIVE ECOLOGY OF MARINE AND FRESHWATER PHYTOPLANKTON, RESHWAIER PHYTOPLANKTON, Michigan Univ., Ann Arbor. Dept. of Biology. P. Kilham, and R. E. Hecky. Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 776-795, July 1988. 7 fig. 3 tab, 97

Descriptors: *Ecology, *Marine environment, *Phytoplankton, Lakes, Reviews, *Limnology, *Aquatic ecosystems, *Model studies, Limiting nu-

A variety of topics currently of interest to phytoplankton ecologists are examined in order to determine the similarities or differences between phytoplankton from each environment. Examination of models of nutrient-limited growth and uptake, nutrient patchiness, resource competition, and r- and K-selection with respect to marine and freshwater hytoplankton indicates that organisms from both habitats are ecologically similar. However, there are differences in the physiology and ecology of phytoplankton within a given habitat (either marine or freshwater) during the course of succession. Even though the identity and basic ecology

or organisms that are present early and late in successional sequences are generally unknown, little is known about their physiology. Marked differences in uptake ability, storage capacity, and growth and loss rates will be found for phytoplankton that can be ranked along an r- and K-selection continuum. This continuum can serve as a unifying concept in phytoplankton ecology. (See also W89-03261) (Author's abstract)

NUTRIENT LIMITATION OF PHYTOPLANK-TON IN FRESHWATER AND MARINE ENVI-RONMENTS: A REVIEW OF RECENT EVI-DENCE ON THE EFFECTS OF ENRICHMENT, Department of Fisheries and Oceans, (Manitoba). Freshwater Inst.

(Maintooa). Freshwater Inst. R. E. Hecky, and P. Kilham. Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 796-822, July 1988. 16 fig, 12 tab, 114 ref.

Descriptors: *Limiting nutrients, *Phytoplankton, *Aquatic ecosystems, *Enrichment *Marine environment, *Reviews, *Limnology, Phosphorus, Nitrogen, Nutrients.

A review of the experimental and observational data used to infer P or N limitation of phytoplankton growth indicates that P limitation in freshwater ton growth indicates that P limitation in resulvater environments can be demonstrated rigorously at several hierarchical levels of system complexity, from algal cultures to whole lakes. A similarly rigorous demonstration of N limitation has not been achieved for marine waters. Therefore, it is concluded that the extent and severity of N limitaconcluded that the extent and severity of similar-tion in the marine environment remain an open question. Culture studies have established that in-ternal cellular concentrations of nutrients deter-mine phytoplankton growth rates, and these stud-ies have shown that it is often difficult to relate growth rates to external concentrations, especially in natural situations. This should lead to a greater reliance on the composition of particulate matter and biomass-based physiological rates to infer nu trient limitation. Such measurements have demonstrated their use in a wide variety of freshwater and marine environments, and most importantly, they can be applied to systems that are difficult to manipulate experimentally or budget accurately. manipulate experimentally or budget accurately. Dissolved nutrient concentrations are most useful in determining nutrient loading rates of aquatic ecosystems. The relative proportions of nutrients supplied to phytoplankton can be a strong selective force shaping phytoplankton communities and affecting the biomass yield/unit of limiting nutrient. (See also W89-03260) (Author's abstract) W89-03261

NUISANCE PHYTOPLANKTON BLOOMS IN COASTAL, ESTUARINE, AND INLAND

North Carolina Univ., Morehead City. Inst. of H. W. Paerl.

N. W. Facht. Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 823-847, July 1988. 7 fig, 1 tab, 170 ref. NSF Grants BSR 86-14951 and OCE 85-00740.

Descriptors: *Aquatic ecosystems, *Limnology, *Blooms, *Bacteria, *Eutrophication, *Nuisance algae, Lakes, Coastal waters, Dinoflagellates, Estuaries, Algae, Marine algae, Phytoplankton.

Upon examining combinations of environmental conditions most likely to elicit nuisance blooms, commonalities and analog situations became more apparent among coastal marine (dinoflagellatedominated), estuarine (denoflagellate and cyano-bacteria dominated), and freshwater (cyanobactorical dominated), and reshwater (cyanobac-teria-dominated) ecosystems. A combination of the following hydrological, chemical, and biotic fac-tors will most likely lead to bloom-sensitive waters: (1) a horizontally distinct water mass; (2) a verti-cally stratified water column; (3) warm weather cally stratified water column; (3) warm weather conditions, as typified by dry monsoon tropical climates and summer seasons in temperate zones; (4) high incident photosynthetically active radi-ation; (5) enhanced allochthonous organic matter loading; (6) enhanced allochthonous inorganic nu-trient loading; (7) adequate availability of essential

metals, supplied by terrigenous inputs or upwelling; (8) underlying sediments physically and nutritionally suitable as seed beds for resting cysts and akinetes; (9) algal-bacterial synergism, which exhibits positive impacts on phycosphere nutrient cycling; (10) algal-micrograzer synergism, which also enhances nutrient cycling without consumption of filamentous and colonial nuisance taxa; and (11) selective activities for macrograzers. Nuisance bloom taxa share numerous additional physiological and ecological characteristics, including limited cai and ecological characteristics, including limited heterotrophic capabilities, high degrees of motility, and toxicity. Given such a set of commonalities, it would appear useful and timely to identify and address generally applicable criteria into the design of water quality management strategies applicable to both coastal and marine and freshwater habitats. (Author's abstract) /89-03262

FACTORS CONTROLLING THE BIOGEOCHE-MICAL CYCLES OF TRACE ELEMENTS IN FRESH AND COASTAL MARINE WATERS AS ARTIFICIAL RADIOISO-TOPES.

Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Due-bendorf (Switzerland). P. H. Santschi.

Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 848-866, July 1988. 5 fig, 1 tab, 104

Descriptors: *Radioactive tracers, *Biochemistry, *Geochemistry, *Trace elements, *Coastal waters, *Aquatic ecosystems, Sediment-water interface, Marine environment, Lakes.

Examples from artificial radionuclide studies in freshwater (Experimental Lakes Area in Northern Ontario ELA) and coastal marine ecosystem enclosures (MERL tanks at Narragansett Bay, Rhode Island) show the cycling of selected trace elements across the sediment-water interface as these are influenced by various biogeochemical factors. The approach to meaningful studies using radiotracers should include the separate characterization of the physical transport processes, and preferably a comparison of the fate of radiotracers to those of stable elements in the same system, to allow for kinetic parison of the fate of radiotracers to those of stable elements in the same system, to allow for kinetic studies of chemical forms. The kinetics of transformation of different chemical species of Co, Hg, Ag, Se, and Cr ions, under variable pH (ELA) or redox(MERL) conditions appeared to be indirectly linked to the kinetics of organic carbon cycling. A better knowledge of the predominant chemical species of trace elements present in these systems will be important in understanding bioavailability, biomagnification, and toxicity of trace elements in aquatic ecosystems. (Author's abstract) W89-03263

COMPARATIVE ECOLOGY OF SUBMERSED GRASS BEDS IN FRESHWATER, ESTUARINE, AND MARINE ENVIRONMENTS,

Maryland Univ., Cambridge. Horn Point Environmental Labs.

J. C. Stevenson

Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 867-893, July 1988. 4 fig, 8 tab, 233

Descriptors: *Ecology, *Estuarine environment, *Marine environment, *Limnology, *Submersed plants, *Submersed plants, *Lakes, *Sea grasses, *Secondary productivity, Grasses, Comparison studies, Angiosperms.

Earlier reviews are discussed and broad compari-Earlier reviews are discussed and broad comparisons are made concerning the ecology of freshwater and marine species of submersed angiosperms. Worldwide, there are 500-700 species of submersed angiosperms adapted to freshwater and estuarine environments compared with 50 species adapted to marine waters. In their evolution from freshwater ancestors, seagrasses have undergone extensive anancestors, seagrasses have undergone extensive an-atomical changes as well as physiological adapta-tion. Seagrasses appear to have more annual pro-duction than do their freshwater counterparts be-cause they develop greater standing crops and

Lakes-Group 2H

have the capacity to store photosynthetic products in extensive rhizome systems in the sediments. For example, maximum productivity of $> 10~{\rm g}$ C/sq m/d has been reported for tropical seagrass speexample, maximum productivity of > 10 g C/sq m/d has been reported for tropical seagrass species, but the maximum productivity of temperature freshwater species or tropical species is usually < 5 g C/sq m/d. In addition, the marine environment provides ample supplies of inorganic carbon and increased mixing energies, making CO2 limitation likely. One calculation suggests that marine macro-phytes impact the global inorganic carbon budget by sequestering as much as 10 to the ninth power t/year. Secondary productivities of seagrass communities can also be high. For example, stable isotopic ratios suggest that macrophytic carbon is important in sustaining several species of commercial fish in Australia, accounting for > 50% of their diets. Also, sea urchins consume plant material, creating bare halos around tropical patch reefs in the Caribbean Sea. It is difficult to generalize regarding brackish submersed aquatics in estuaries because their coverage is variable due to light limitation and algal overgrowth from eutrophication. Freshwater macrophytes seem rarely grazed by fish, but waterfowl use is often significant at the end of the growing season. Then, trophic relations in freshwater macrophyte beds may be qualitative-limitation and much more pulsed than in seagrass systems, with more r-selection in lakes and more K-selection in marine environments. (Author's abstract) stract) W89-03264

FORESTED WETLANDS IN FRESHWATER AND SALT-WATER ENVIRONMENTS, Institute of Tropical Forestry, Rio Piedras, PR. A. E. Lugo, S. Brown, and M. M. Brinson. Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 894-909, July 1988. 3 tab, 132 ref.

Descriptors: *Wetlands, *Lakes, *Seawater, *Reviews, *Limnology, *Forest hydrology, *Forests, *Forest watersheds, Ecosystems, Productivity.

A review of data from over 50 freshwater and A review of data from over 30 freshwater and about 50 salt-water sites revealed that freshwater and salt-water forested wetlands exhibit parallel responses to hydrologic factors. Greater ecosystem complexity and productivity are associated with higher hydrologic energy and more fertile conditions. However, structural complexity is greater in freshwater forested wetlands than in salt-water wetlands. West primary productivity litter fall and freshwater forested wetlands than in salt-water wetlands. Net primary productivity, litter fall, and export of organic matter are higher in salt-water forested wetlands. These differences raise questions about the efficiency with which nutrients are used in forested wetlands. Available data suggest that nutrient-use efficiency by litter fall and litter turnover are higher in tidal salt-water wetlands than in freshwater wetlands. (Author's abstract) W89-03265

PRODUCTION AND USE OF DETRITUS IN VARIOUS FRESHWATER, ESTUARINE, AND COASTAL MARINE ECOSYSTEMS, Bedford Inst. of Oceanography, Dartmouth (Nova Scotia), Marine Ecology Lab.

K. H. Mann.

Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 910-930, July 1988. 15 fig, 1 tab, 100 ref.

Descriptors: *Detritus, *Lakes, *Estuarine environment, *Marine environment, *Food chains, *Plankton, *Reviews, *Limnology, *Nutrients, Coastal waters, Organic matter.

The extent to which detritus pathways support the production of invertebrates and fish, and the extent to which they lead mainly to the production of CO2 in microbial respiration and to the regeneration of nutrients, are discussed. The relative importance of plant detritus derived from vascular plants (salt marsh grasses, seagrasses, mangroves) and that derived from seaweeds and other algae is also addressed. In the 1980s, it was shown, particularly for freshwater habitats, that the dissolved organic matter released by plants while living or in the early stages of decomposition readily precipitates on surfaces and forms amorphous particulate matter with a low content of refractory material.

These particles are highly nutritious for animals and are used directly by freshwater fish which is commercially important, especially in Africa and South America. It is suggested that the dissolved organic matter pathway may be ecologically more significant than the particulate organic matter pathway and these particulates organic matter pathway may be ecologically more significant than the particulate organic matter pathway may be expected these particulates or an expected the particulate organic matter pathway and these particulates or an expected particulate organic matter pathway and these particulates or an expected particulate organic matter pathway and these particulates or an expected particulate organic matter pathway and the particulate organic matter pathway and path significant than the particulate organic matter pathway and that processes analagous to those shown for lakes and rivers probably occur in estuarine and coastal waters. There is much circumstantal evidence to suggest that planktonic food webs based on dissolved organic matter are much more important than previously thought. The conversion of dissolved organic matter to particulate organic matter through the microbial loop and its use in higher trophic levels is an urgent topic for further study. (Miller-PTT)

ECOLOGICAL PRINCIPLES AFFECTING COMMUNITY STRUCTURE AND SECOND-ARY PRODUCTION BY ZOOPLANKTON IN MARINE AND FRESHWATER ENVIRON-MENTS,

MENIS, Michigan Univ., Ann Arbor. Dept. of Biology. J. T. Lehman. Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 931-945, July 1988. 4 fig, 2 tab, 109 ref.

Descriptors: *Secondary productivity, *Ecology, *Zooplankton, *Limnology, *Marine environment, *Lakes, Animal population, Regression analysis.

The production dynamics of zooplankton have been studied within two alternative conceptual been studied within two alternative conceptual frameworks. Some workers have emphasized the species composition of communities and the repro-ductive success of individual species, whereas others have studied the flow of nutriens and others have studied the flow of nutrients and energy among ecosystem components. The reduced phylogenetic diversity of lake plankton compared with marine systems has favored the development of species-based community ecology by limnologists. Theories that promote size structure as the salient community feature have been pioneered in marine systems and sometimes adopted for freshwater work. Empirical trends in physical cological processes with organism size nermit some dor freshwater work. Empirical trends in physiological processes with organism size permit some rates to be estimated from size structure alone. With few exceptions, however, coefficients derived from log-transformed regression equations have been applied uncritically in models, and little regard has been given to the large estimation errors involved. Metrics that are based on differences between physiological processes, are important ecologically. Threshold food concentration is an example; it measures the relative importance of food acquisition ability compared to acquisition and maintenance costs. These integrative properties do not vary strictly with organism size and they illustrate the fact that the biological entities can develop many alternative solutions to the they inustrate the fact that the biological entities can develop many alternative solutions to the problems they face. Such results imply that whenever resource exploitation influences community composition, organism-specific adaptations will prove more predictive than size structure. (Author's abstract) W89-03267

COMPARATIVE ECOLOGY OF THE MACRO-FAUNA OF FRESHWATER AND MARINE MUDS, State Univ. of New York at Stony Brook. Marine Sciences Research Center.

G. R. Lopez.

Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 946-962, July 1988. 3 tab, 133 ref.

Descriptors: *Ecology, *Fauna, *Lakes, *Marine environment, *Mud, *Benthos, *Limnology, *Reviews, *Aquatic environment, *Microfauna, *Benthic fauna, Comparison studies.

Certain fundamental differences between lacustrine and neritic habitats and how they control the be-havior of benthic organisms and the organization of benthic communities are reviewed. There are many striking similarities between the benthic ma-crofauna inhabiting marine and lacustrine sedi-ments. Most of the same trophic/functional groups

are well represented in both habitats. There is no obvious difference between the types of particulate food sources available for microphagous animals. Temperate lakes and nertitic environments support a similar standing stock of macrofauna, which is a function of similar detrital input to the benthos. There is no characteristic difference in P:B ratios between marine and freshwater macrobenthos. Predation and competition have similar important effects on community structure. Likewise, community succession appears to follow the same pattern. There are certain differences between marine and freshwater macrobenthos, however, that appear to freshwater macrobenthos, however, that appear to relate to fundamental habitat differences. The relate to fundamental habitat differences. The major difference is that low salimity and the closed, ephemeral nature of most lakes have resulted in little taxonomic similarity between the two faunas. Tentaculate deposit feeders are found only in marine sediments, and interstitial suspension feeders are common only in freshwater muds. The ability to use dissolved organic matter is well developed only in marine animals, which is a consequence of the osmotic problems faced by freshwater animals. The ability of many limnetic species to survive prolonged anoxia relates to the lack of tidal mixing in lakes. (Author's abstract) W89-03268

ACCOUNTING FOR EFFORT WHEN COM-PARING TROPICAL FISHERIES IN LAKES, RIVER-FLOODPLAINS, AND LAGOONS,

Illinois Natural History Survey, Champaign. P. B. Bayley.

Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 963-972, July 1988. 3 fig. 5 tab, 42

Descriptors: *Tropical regions, *Fisheries, Flood plains, Lagoons, *Limnology, *Tropical fisheries, Lakes, Rivers, Lake fisheries, Stream fisheries, Es-tuarine fisheries, Model studies, Africa.

Data from 59 tropical fisheries which were artisanal and multispecies in character indicated that fishing effort was a major determinant of yield. Effort was defined as number of full- and part-time fisherman. The largest subset, which comprised 31 African lake fisheries, conformed to a function related to the Schaefer model. Data from different lakes were thus treated as samples from a hypothetical multispecies fishery. The model explained 75% of the variance in log (yield). The residuals were correlated (P < 0.05) with log (morphoedaphic index). The effort model and the morphoedaphic index) into a cocount for the nonlinear effect of fishing effort was proposed for sets of fisheries conforming to the model. Data from river-floodplain and lagoon fisheries were very similar and were best described by the same effort model. Differences in the model parameters for these fisheries compared to those of lakes suggested differences in effective effort. A precision improvement index was proposed to compare the predictive allow fifterent predictors and transformations. A comparison of the predictability of yields revealed that, despite variation in socioeconomics, commercialization and biological productivity between fisheries, this crude effort measurement was more important than indices of productivity for these sets of fisheries. Future progress in predicting and understanding Data from 59 tropical fisheries which were articommercialization and biocertain productivity between fisheries, this crude
effort measurement was more important than indices of productivity for these sets of fisheries.
Future progress in predicting and understanding
fisheries yields depends on the synchronized collection of variables that relate to the fishery and to
the biological productivity in numerous comparable systems. (Author's abstract)
W89-03269

APPLICABILITY OF FISH YIELD INDICES IN FRESHWATER AND MARINE ECOSYSTEMS, Bedford Inst. of Oceanography, Dartmouth (Nova Scotia), Marine Ecology Lab. S. R. Kerr, and R. A. Ryder.

Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 973-981, July 1988. 42 ref.

Descriptors: *Marine environment, *Aquatic ecosystems, *Limnology, *Fisheries, Lakes, Rivers, Ecosystems, Fish yield indicators.

Group 2H-Lakes

The use of fish yield indicators in freshwater and marine environments is explored with specific interest in predictive yield indices that are inexpensive and easy to apply, particularly in scattered fisheries of small economic value. Marine fisheries are subject to external forcing by physical factors over a much larger range of size scales than are freshwater fisheries, but there are many similarities in the way the process of fish production is organized. Fish yield indicator, particularly those based on abiotic environmental factors, have provided useful management tools in both environments. Examples from each, including a separate category for rivers and impoundments because of their particular sensitivity to physical factors, are discussed. It is concluded that the apparent dichotomy be-It is concluded that the apparent dichotomy be-tween freshwater and marine fisheries science re-sults as much from differing management impera-tives as from any scientific distinctions and it is suggested that there would be advantages to fuller communication between the disciplines. (Author's abstract) W89-03270

FRESHWATER AND MARINE COUPLING IN ESTUARIES OF THE MISSISSIPPI RIVER DELTAIC PLAIN, Louisiana State Univ., Baton Rouge. Center for Wetland Resources. For primary bibliographic entry see Field 2E. W89-03271

PHYSICAL ENERGY INPUTS AND THE COM-PARATIVE ECOLOGY OF LAKE AND MARINE ECOSYSTEMS, Rhode Island Univ., Narragansett. Graduate School of Oceanography. For primary bibliographic entry see Field 2A. W89-03272

EFFECTS OF CADMIUM EXPOSURE ON FEEDING OF FRESHWATER PLANKTONIC CRUSTACEANS

Limnologisch Inst., Nieuwersluis (Netherlands). Vijverhof Lab. For primary bibliographic entry see Field 5C. W89-03288

PREDICTION OF RESERVOIR PHYTO-PLANKTON CONDITION BY THE FLUORES-

PLANKTON CONDITION BY THE FLUORES-CENCE METHOD, Institute of Biophysics, Krasnoyarsk (USSR). A. Y. Bolsunovskii, I. A. Terskov, F. Y. Skid'ko, L. A. Shur, and A. D. Aponasenko. Doklady Biological Sciences DKBSAS, Vol. 297, No. 1-6, p 624-626, May 1988. 3 fig. 6 ref. Translat-ed from Doklady Akademii Nauk, Vol. 297, No. 6, pp. 1509-1511, December, 1987.

Descriptors: *Fluorescence, *Phytoplankton, *Reservoirs, *Algae, *Limnology, *Water quality, Eutrophication, Soviet Union, Luminostats, Bio-

The fluorescence method was used to study the condition and development of reservoir phyto-plankton. The study was conducted in 1985-86 at the field station of the Institute of Biophysics, Siberian Department, Academy of Sciences of the USSR, in the vicinity of Syday Bay. A luminostat, USSR, in the vicinity of Syday Bay. A luminostat, which makes it possible to model optimal surface conditions, was used to expose phytoplankton samples collected during a biosurvey of various regions of the bay. On a daily basis throughout the experiments, the induction transitions of phytoplankton chlorophyll fluorescence were recorded, and the algal numbers and biomass were determined by standard methods. A laboratory fluorometer was used to record the induced fluorescence transitions. The fluorescence method for monitoring algal community development under laboratoring algal community development under laboratoring ransitions. The indirection mention for monitoring algal community development under laboratory and natural conditions makes it possible to effectively identify the direction and supposed rates of development of mass representatives of the phytoplankton. Using supplements of biogenic elements to identify the limiting factor, it is possible to purposefully prepare for negative algal bloom phenomena and to plan measures to block their development. (Miller-PTT)

W89-03291

EFFECT OF CLIMATE ON DEVELOPMENT OF TWO SPHAGNUM BOGS IN SOUTH-CEN-TRAL WISCONSIN

Wisconsin Univ., Madison. Inst. for Environmental Studies

M. G. Winkler. Ecology ECOLAR, Vol. 69, No. 4, p 1032-1043, August 1988. 4 fig. 2 tab, 74 ref. NSF Grants ATM 82-19079 and ATM 84-12958.

Descriptors: *Limnology, *Paleoclimatology, *Wisconsin, *Climates, *Bogs, *Macrophytes, *Wetlands, Paleohydrology, Pollen, Radioactive dating, Sphagnum, Charcoal.

Aquatic pollen, charcoal, sediment, and accumula-tion-rate changes from radiocarbon-dated cores from two sites on south-central Wisconsin were from two sites on south-central Wisconsin were studied to explore the evolution of local wetlands since deglaciation. Sphagnum bog evolution in south-central Wisconsin appears to have been directly related to the regional climatic changes during the past 6000 years. Although the two sites had different origins and different early histories, both were deep lakes until 6300 BP when they became shallow ponds dominated by the aquatic macrophyte Brasenia. These wetland changes were concurrent with a regional unland wegetational macrophyte Brasenia. These wetland changes were concurrent with a regional upland vegetational change from mesophytic forest to Quercus savanna and were caused by a regional decrease in annual precipitation and by an increase in temperature. At about 3000 BP, in response to a cooler, wetter climate, both wetlands became Sphagnum-Ericaceae bogs, and the upland vegetation changed to a closed Quercus forest. The paleoecological evidence suggests that bog development is a function of climate and that many bogs have developed in the northern Midwest during the past 3000 years as effective moisture has increased. (Author's abstract) stract) W89-03293

FERTILITY AND DISTURBANCE GRADI-ENTS: A SUMMARY MODEL FOR RIVERINE MARSH VEGETATION, Ottawa Univ. (Ontario). Dept. of Biology. R. T. Day, P. A. Keddy, J. McNeill, and T.

Carleton

Ecology ECOLAR, Vol. 69, No. 4, p 1044-1054, August 1988. 5 fig, 4 tab, 62 ref.

Descriptors: *Marshes, *Wetlands, *Vegetation, *Stress, *Limnology, *Ecology, *Canada, TWIN-SPAN, Multivariate analysis, Ottawa River, Water depth, Flooding, Ecosystems, Model studies, Litter, Rivers, Competition.

Multivariate vegetation data were used to describe the vegetation-environment relationships in a set of riverine wetlands and general relationships be-tween pattern and process are explored. Samples collected from five marshes along the Ottawa River (eastern Canada). Detrended correspond-River (eastern Canada). Detrended correspondence analysis was used to describe major gradients, and TWINSPAN was used to classify vegetation types. TWINSPAN produced four major classes dominated by Sparganium eurycarpum, Eleocharis smallii, Scripus americanus and Typha latifolia. Within each class, two associations could be recognized, differing in the degree to which one species managed to dominate the vegetation. Ordination showed that these vegetation types were arranged along two major axes: (1) a standing crop and litter gradient; and (2) a water depth gradient. Species richness was greated into the control of the control o along two major axes: (1) a standing crop and litter gradient; and (2) a water depth gradient. Species richness was greatest just above the late August waterline in Eleocharis smallii vegetation that had low fertility, intermediate total biomass (250 g/sq m) and low littermass (30 g/sq m). Very high biomass (> 400 g/sq m) was observed where indices of high fertility and low disturbance coincided. Low species richness in this Typha-dominated vegetation is thought to be a result of competitive exclusion. Exposure to waves, ice, and flowing water produced a fertility gradient. The least fertile sites had small evergreen species such as Eriocaulon septangulare and Ranunculus flammula. These species possessed traits associated with Grime's stress tolerator strategy. The three main factors controlling vegetation composition were

water depth, the effects of spring flooding in re-moving litter, and the fertility gradient produced by waves and flowing water. These were incorpo-rated into a conceptual model including both pat-terns and processes observed along the Ottawa River. (Author's abstract) W89-03294

HYDROCHORY AND REGENERATION IN A BALD CYPRESS-WATER TUPELO SWAMP FOREST,

Savannah River Ecology Lab., Aiken, SC. R. L. Schneider, and R. R. Sharitz. Ecology ECOLAR, Vol. 69, No. 4, p 1055-1063, August 1988. 4 fig. 1 tab, 47 ref. DOE contract DE-ACO9-76SR00819.

Descriptors: *Hydrology, *Seeds, *Limnology, *Seed dispersal, *Wetlands, *Swamps, Savanah River, Flood plains, Floods, Bald cypress trees, Water tupelo trees, Rivers, South Carolina, Seasonal variation, Water depth, Hardwood.

The importance of hydrochory, or seed dispersal by water, to the regeneration of Taxodium disti-chum (bald cypress) and Nyssa aquatica (water tupelo) was examined in a forested floodplain of tupero) was examined in a forested noouplant of the Savannah River in South Carolina. Seedfall and dispersal by water were quantified for 2 years using floating seed traps. Water depth, surface velocity and flow direction were monitored over the same period. Seedfall for bald cypress and water tupelo occurred primarily from early fall. throughout the winter, when water levels were rising in the swamp. Extended buoyancy periods ising in the swamp. Extended diospanel periods for newly released seeds and fruits prolonged dis-persal for both species. Flowing water transported experimentally released seeds long distances, but in a uniform direction, and concentrated them nonrandomly against logs, trees, knees and other emergent substrates. An examination of the soil seed banks in five microsite types supported the results of the seed transport study. Lowest woody seed densities occurred in open areas, and highest seed densities occurred in sediments adjacent to emergent substrates such as logs. Additionally, elevated water levels of 1-2 m caused by short-term, high-discharge floods scoured seeds of Nyssa sylvatica var. biflora, Quercus spp., Liquidambar styraciflua, Pinus taeda, and other species form adjacent bot-tomland hardwood communities and transported them into the bald cypress-water tupelo forest. It is concluded that elevated water levels, which occur concluded that elevated water levels, which occur during late fall when seeds are released, influence the distribution of bald cypress and water tupelo seeds and their availability for recruitment. Short-term, deeper floods may also be important for seed transport among bottomland hardwood communi-ties that are spatially separated or differ in species composition. (Author's abstract) W89-03295

RESULTS OF A SHORT-TERM TOXICITY STUDY FOR THREE ORGANIC CHEMICALS FOUND IN NIAGARA RIVER DRINKING

Environmental Health Directorate, Ottawa (Ontario). Environmental and Occupational Toxicology

For primary bibliographic entry see Field 5C. W89-03310

PESTICIDES IN FISH TISSUE AND WATER FROM TUTTLE CREEK LAKE, KANSAS,

Kansas Dept. of Health and Environment, Topeka. Div. of Environment. For primary bibliographic entry see Field 5B. W89-03317

ORGANIC CONTAMINANTS IN ISOLATED LAKES OF SOUTHERN LABRADOR, CANADA,

Department of the Environment, London (England). Water Engineering Directorate.
For primary bibliographic entry see Field 5B. W89-03318

Erosion and Sedimentation—Group 2J

CHLORINE SENSITIVITY OF EARLY LIFE STAGES OF FRESHWATER FISH, Science Applications, Inc., Oak Ridge, TN. For primary bibliographic entry see Field 5C. W89-03333

2I. Water In Plants

EARLY LIFE HISTORY AND WINTER MORTALITY OF GIZZARD SHAD IN LAKE SHARPE, SOUTH DAKOTA, Fish and Wildlife Service, Pierre, SD. North Central Reservoir Investigations. For primary bibliographic entry see Field 2H. W89-02429

RESPONSES OF FOUR IRISH WETLAND TREE SPECIES TO RAISED SOIL WATER

TREE SPECIES TO RAISED SOIL WATER LEVELS, Trinity Coll., Dublin (Ireland). School of Botany. For primary bibliographic entry see Field 2H. W89-03128

RADIAL STEM GROWTH OF CONIFEROUS TREES NEAR SWEDISH RESERVOIRS, Umea Univ. (Sweden). Dept. of Ecological Botany. For primary bibliographic entry see Field 6G. W89-03142

ROLE OF THE SEED BANK IN THE DEVELOPMENT OF VEGETATION ON A FRESHWATER MARSH CREATED FROM DREDGE SPOIL,
Ohio State Univ., Columbus. Environmental Biol-

ogy Program.
For primary bibliographic entry see Field 2H.
W89-03169

RESPONSE OF COASTAL PLANTS TO IN-CREASE IN SUBMERGENCE AND SALINITY, Louisiana State Univ., Baton Rouge. Lab. for Wet-land Soils and Sediments. For primary bibliographic entry see Field 2L. W89-03188

2J. Erosion and Sedimentation

BLOUNTSTOWN REACH, APALACHICOLA RIVER, MOVABLE-BED MODEL STUDY, Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab. R. A. McCollum.

Available from the National Technical Information Service, Springfield, VA. 22161 as AD-A199360. Price codes A03 in paper copy, A01 in microfiche. Technical Report HL-88-17, August 1988. Final Report. 39p, 1 fig, 2 tab, 21 plates.

Descriptors: *Scour, *Stream erosion, *Sediment transport, *Dredging, *Blountstown Reach, *Apalachicola River, *Hydraulic models, Thalwe, Waste disposal, Navigation channels, Artificial intercourses, Navigable rivers, Florida.

The Blountstown Reach, Apalachicola River, is located between navigation miles 81 and 76. This area requires approximately 107,000 cu yd of dredging annually to maintain the navigation channel. The model study was conducted to examine the dredged material disposal in the thalweg and within the bank and to develop a system of contraction works to develop and maintain the navigation channel with little or no maintenance dredging. The model built to a horizontal scale of 1:100. in channel with little or no maintain the naviga-tion channel with little or no maintenance dredg-ing. The model, built to a horizontal scale of 1:120 and a vertical scale of 1:80, was of the movable-bed type and allowed for inflow from both the Apalachicola River and Sutton Lake. Results of the study indicate the following: (1) Thalweg dis-posal of dredged material had little effect on chan-nel maintenance during low- or average-water years; but following high-water years, dredging would be significantly greater; (2) Within-bank dis-posal of dredged material provided some improve-ment of the navigation channel during low- and average-water years, but required much more

dredging than typical following high-water years; (3) Plan A provided little improvement in maintaining a navigation channel; and (4) Plan B developed and maintained an adequate navigation channel during all water years tested except for a marginal channel crossing at mile 77.40. (Lantz-PTT) W89-02416

JEFFERSON BARRACKS BRIDGE, MOVA-BLE-BED MODEL STUDY.

J. E. Foster. Available from the National Technical Information Service, Springfield, VA. 22161 as AD-A199359. Price codes: A04 in paper copy; A01 in microfiche. Miscellaneous Paper HL-88-7, August 1988. Final Report. 56p, 12 fig, 22 plates, 3 append.

Descriptors: *Channel erosion, *Stream erosion, *Construction methods, *Scour, *Jefferson Baracks Bridge, *Hydraulic models, Model studies, Cofferdams, Trestles, Detritus, River flow, Piers, Mississippi River, Artificial watercoures

In July 1977, the Illinois Dept. of Transportation awarded a contract to construct piers for interstate Highway 255 Bridge across the Mississippi River at mile 168.7. As of March 1979, the contractor had constructed a work trestle across Jefferson at mile 168.7. As of March 1979, the contractor had constructed a work trestle across Jefferson Barracks Slough and a work trestle from the island to a point past pier 10. The contractor also had constructed cofferdams for the construction of piers 5-10, 12, and 13. In the spring of 1979, the discharge in the river increased, and debris accumulated upstream of the work trestle. On 21 March 1979, the portion of the work trestle between cofferdams at piers 9 and 10 failed. It is not known exactly when the cofferdams at pier 10 failed, but it is assumed that it failed about the same time as the trestle between cofferdams at piers 9 and 10 failed. By 19 April 1979, the cofferdam at pier 9 and the portion of the work trestle between cofferdams at piers 8 and 9 had failed. This study was conducted to investigate a the relationship of the existence of the work trestle, the cofferdams, and the accumulation of debris that occurred upstream of the work trestle to the riverbed moveand the accumulation of deepts that occurred up-stream of the work trestle to the riverbed move-ment that occurred before, during, and after the failure of the work trestle and cofferdams. Results obtained during the model study indicate the fol-lowing: (1) Discharges of the magnitude of the 1979 flood (maximum of 685,000 cfs) would result in minimal bed scour of the left side of the river; in minimal bed scour of the left side of the river; (2) The addition of the work trestle and cofferdams would have no effect on general bed scour; and (3) The addition of the 10-acre area of debris (9- and 18-ft thicknesses) that accumulated upstream of the work trestle would cause flow in the area to be concentrated under and around the west end of the debris. This concentrated flow would scour the bed of the river in the vicinity of the west end of the work trestle. The depth of scour in the vicinity of the work trestle would vary directly with the thickness of the debris. (Lantz-PTT) W89-02417

SEDIMENT TRANSPORT IN GRAVEL-BED

Queen Mary Coll., London (England).
John Wiley and Sons, New York. 1987. 995p.
Edited by C. R. Thorne, J. C. Bathurst and R. D.

Descriptors: *Alluvial channels, *Sediment transport, *Sediment load, *Fluvial sediments, *Bed load, *Suspended load, Model studies, Case studies, Mathematical models, Scour, Sediment erosion, Reservoir silting, Gravel, Fisheries, Sampling, Environmental effects, Sampling, Sediment discharge, Channel improvement, Channel erosion, Geomorphology.

The second gravel-bed rivers workshop was held at Pingree Park, Colorado State University from August 11 to 17, 1985 to synthesize current knowledge on sediment transport in gravel-bed rivers, concentrating particularly on information gained since 1980. Thirty-two papers on sixteen topics were presented, divided equally between fundamental problems and engineering case studies. All the papers benefited from extended oral discussion

with particularly lively debates on the topics con-cerned with sediment sampling techniques, supply-limited sediment transport rates, grain mobility and the armoring process, sediment routing by size fraction, bed load pulses, braided rivers, extremal hypotheses and fines infiltration in matrix gravels of armored beds. The sixteen topics covered in-clude: reviews of gravel-bed river sediment trans-port; sampling and analysis of river bed gravels and bed loads; sediment supply to upland streams and unstable gravel-bed rivers; large-scale sedi-ment processes: armoring processes: channel int processes; armoring processes; channel sign (case studies); modelling sediment transport; design (case studies); modelling sediment transport; tests of bed load equations; mountain rivers (case studies); observation of bed load movement (case studies); suspended load in gravel-bed rivers; river regime; bar and bed load interaction; design problems (case studies); fisheries and habitats (case studies); gravel mining (case studies). (See W89-02431 thru W89-02462) (Geiger-PTT) W89-02430

DIFFERENCES BETWEEN GRAVEL AND SAND-BED RIVERS, Simons and Associates, Inc., Fort Collins, CO.

D. B. Simons, and R. K. Simons.

IN: Sediment Transport in Gravel-Bed Rivers.

John Wiley and Sons, New York. 1987. p 3-45, 2 fig. 1 ref.

Descriptors: *Geomorphology, *River beds, *Bed load, *Sediment transport, Sediment erosion, Flu-vial sediments, Sand, Gravel, Streambeds, Sedi-ment discharge, Flow profiles, Streamflow.

As rivers form and flow from the mountains and plains seaward, they encounter a wide array of physical conditions, each of which can have a significant effect on the characteristics and resignificant effect on the characteristics and re-sponses of various components of the system. Broadly speaking, rivers can be subdivided into gravel-bed and sand-bed rivers. Both types often occur in a single system. To better identify, ana-lyze and develop these systems, it is essential to recognize the similarities and differences between them and how one type may blend into the other. Some of the major differences that must be considered include: river form, the wide array of forms of bed roughness, the varying magnitudes of resistance factors, the mechanics of transport of bed material for the numerous conditions encountered, the impacts of wash load on bed material for the numerous conditions encountered, the impacts of numerous conditions encountered, the impacts of wash load on bed material transport, the mechanics wash load on bed material transport, the mechanics of bed armoring, the characteristics and erodibility of the banks, and the impacts of varying river conditions on water resources development, navigation and the environment. With an appreciation of the major differences between sand- and graveled rivers, it will be possible to identify existing acceptable concepts and theories, and identify research that must be conducted to improve understanding of these complex systems. (See also W89-02430) (Author's abstract)

RIVER DYNAMICS, FLOW REGIME AND SEDIMENT TRANSPORT, University of East Anglia, Norwich (England). School of Environmental Sciences. R. D. Hey.

IN: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 17-40, 9 fig, 13 ref.

Descriptors: *Sediment transport, *Flow profile, *Streamflow, *Channel erosion, Sediment erosion, Stable channels, Channel morphology, Sediment discharge, Dredging, Channel improvement,

Rivers are very effective erosional and depositional agents which, over periods of geological time, are responsible for major landscape modification. In the early phase of channel development morphological and sedimentological evidence indicates a complex interaction between cut and fill activity. Periods of stability are relatively rare. Subsequently, as the supply of transportable material declines, the river system tends towards a more stable

Group 2J—Erosion and Sedimentation

regime condition. During periods of erosion and regime condition. During periods of erosion and deposition the flow regime and sediment transport characteristics of the river are changed in a sys-tematic manner in response to temporal and spatial changes in channel geometry and bed material size. Field data indicate that regime channel capacity is determined by the flow which collectively transdetermined by the flow which collectively transports most material. When eroding or depositing, channel capacity is controlled by the flows which collectively transports most material. When eroding or depositing, channel capacity is controlled by the flows which are responsible for most degradation or aggradation. In rivers originating in young mountain belts unstable conditions are likely to prevail in the headwaters with more stable conditions downstream. Rivers developed in tectonically stable areas which have been unaffected by glacial activity are more likely to exhibit regime type conditions. To manage any river system effectively it is necessary to have due regard for its degree of long-term stability. River response to any natural or imposed changes will depend on the degree of change and the prevailing stability of the channel. (See also W89-02432) (Author's abstract)

RIVER BED GRAVELS: SAMPLING AND ANALYSIS, British Columbia Univ., Vancouver. Dept. of Geography. For primar W89-02433 nary bibliographic entry see Field 7B.

BED LOAD SAMPLING AND ANALYSIS, Geological Survey, Lakewood, CO. D. W. Hubbell. IN: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 89-118, 8 fig, 1 tab, 12 ref.

Descriptors: *Bed load samples, *Alluvial chan-nels, *Network design, *Bed load, *Sampling, *Fluvial sediments, Sediment transport, Temporal distribution, Computer models, Simulation analy-sis, Bottom sampling, Sand, Gravel, Statistics.

The extreme temporal variations in transport rates that are inherent in the process of bed load movement present unique problems in the calibration and use of portable direct-measuring bed load samplers. Laboratory and field measurements of sand and gravel transport demonstrate that, even at constant-flow conditions, transport rates at a point vary cyclically with time from zero (or near zero) vary cyclically with time from zero (or near zero) to approximately four times the mean rate. Cumulative distributions of ordered rates obtained sequentially at a point tend to follow a common distribution function. Due to the extreme temporal variability of transport rates, bed-load-sampler calibrations developed from averages of groups of samples and measured rates are subject to error unless the sampler has a constant sampling efficiency for all instantaneous transport rates. Laboratory calibrations by a technique called probability. cy tor all instantaneous transport rates. Latoratory calibrations by a technique called probability-matching, in which the entire distributions of sampled and measured rates are compared, show that efficiencies of all tested bed load samplers varied somewhat with transport rate and particle size. The accuracy of measurements of mean transport rate at a cross-section is also affected by the temporal statistics in had a likely state of the contraction. rate at a cross-section is also affected by the temporal variations in bed load discharge. Computer simulations, using assumed lateral distributions of mean transport rate and a simplified model of transport that is based on typical cyclic rate variations, show that repetitive sampling at each lateral position improves accuracy, and measurement effort probably can be decreased, without sacrificenter propagi can be decreased, without sacrific-ing accuracy, by sampling repetitively only at posi-tions necessary for defining the lateral distribution of mean transport rates. (See also W89-02430) (Au-thor's abstract) W89-02434

SEDIMENT SUPPLY TO UPLAND STREAMS: INFLUENCE ON CHANNEL ADJUSTMENT, Liverpool Univ. (England). Dept. of Geography.

In: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 121-150, 14 fig, 1 tab, 26 ref.

Descriptors: *Geomorphology, *Channel morphology, *Alluvial channels, *Sediment transport,

*Channel erosion, *Unstable channels, Sediment discharge, Fluvial sediments, Sediment erosion, Sediment transport, Storm runoff.

Two types of channel system are identified in the I'wo types of channel system are meanined in an Howgill Fells of northwest England, in relation to sediment input from the hillslopes. In areas of low sediment supply, stable, single, often meandering channels occur, whose widths and gradients show a high degree of correlation with drainage area and coarse sediment caliber. In gullied catchments of coarse sediment caliber. In guilled catchments of high sediment input the channels are unstable and braided with much greater widths and steeper gra-dients. Rates of sediment supply from a gully system, cut in soliflucted glacial till, to an unstable channel have been monitored. From the gullied channel have been monitored. From the gullied area of 4000 sq m total sediment supply is > 150 tons/yr, of which about one-third is of coarse sediment. There is a marked seasonality of supply mechanism with winter dominant, especially for coarse sediment. Debris cones build up at the base of the gullied slopes and are entrained by stream floods of approximately two years recurrence interval. The coupling of the sediment supply, storage, entrainment and channel response system is adjusted to this range of time scales. In 1982 a storm with a return period in excess of 100 years caused major erosion and a massive sediment input caused major erosion and a massive sediment input to two hitherto stable meandering channels. By to two hitherto stable meandering channels. By widening, straightening and aggradation many reaches crossed a threshold to a braided regime. Whether these changes persist will depend on sediment supply and flood magnitude over the next few years. Even if stabilization takes place the boulders transported by the floods will have a long-term influence on the channel system. (See also W89-02430) (Author's abstract)

SEDIMENT SUPPLY, MOVEMENT AND STORAGE IN AN UNSTABLE GRAVEL-BED

Colorado State Univ., Fort Collins. Dept. of Earth

Resources.
J. C. Pitlick, and C. R. Thorne.
IN: Sediment Transport in Gravel-Bed Rivers.
John Wiley and Sons, New York. 1987. p 151-183,
16 fig, 1 tab, 22 ref.

Descriptors: *Dam failure, *Geomorphology, *Alluvial channels, *Channel erosion, *Channel morphology, *Floods, *Sediment transport, River beds, Sediment erosion, Sediment load, Unstable channels, Flood discharge, Fluvial sediments,

The 15 July 1982 failure of Lawn Lake dam, Rocky Mountain National Park, Colorado, gener-Rocky Mountain National Park, Colorado, generated a peak flood discharge of 340 cu m/sec, which was approximately 30 times the 500-year event. Floodwaters devastated the channel of Roaring River from the dam to its confluence with Fall River. As a result of this catastrophe, the sediment load of these streams has increased greatly and their channels have undergone rapid and significant changes. Since the flood, increased sediment transport, rates, and morphological changes. significant changes. Since the flood, increased sediment transport rates and morphological changes have been documented during snowmelt- and thunderstorm-generated flows. In 1983, record snowmelt discharges produced high sediment loads in Roaring River. This sediment was transported about 3 km downstream to an undisturbed, highly sinuous reach and deposited in a storage zone that was approximately 2000 m long. Within the storage zone, the channel aggraded approximately 0.75 m to the level of the flood plain. Sediment transport below this depositional zone was low in 1983. In 1984, snowmelt discharges were lower and sediport below this depositional zone was low in 1983. In 1984, snowmelt discharges were lower and sediment delivery from Roaring River decreased, but transport in Fall River was maintained. As a result, the upper end of the storage zone was eroded to the pre-flood bed. Thunderstorm flow events contrasted sharply, however, with renewed erosive activity in the Roaring River valley, again contributing high loads to Fall River, but only for short durations. (See also W89-02430) (Author's abstract) W89-02436

TRANSPORT PROCESSES AT THE CATCH-MENT SCALE.

Institute of Hydrology, Powys (Wales). Fluvial Geomorphology Unit

M. D. Newson, and G. J. Leeks.
IN: Sediment Transport in Gravel-Bed Rivers.
John Wiley and Sons, New York. 1987. p 187-223,
14 fig. 4 tab, 62 ref.

Descriptors: *Alluvial channels, *Sediment yield, *Sediment transport, *Fluvial sediments, *Runoff, Land use, Sediment erosion, Catchment areas, Channel improvement, Sediment load, Wales, Monitoring, Suspended sediments.

It is traditional for engineers in the United King-It is traditional for engineers in the United King-dom to take a reach approach to researching river dynamics. Given relatively stable patterns of runoff and low sediment yields in the humid tem-perate climate, the reach has also been considered the appropriate scale at which to stabilize channels. However, source area studies in the United King-dom reveal trends in both runoff and sediment dom reveal trends in both runoff and sediment production; these are caused by changes in land-use and land management. There are also signs that source-area changes, especially in the uplands, are having downstream effects in terms of bank erosion and shoal/bar deposition. The paper reports a five-year study of the major rivers of mid-Wales, five-year study of the major rivers of mid-Wales, centered on the Plynlimon upland. Techniques employed were bed and suspended sediment monitoring, sediment tagging by the magnetic method, ground survey, sedimentological/hydraulic survey and historical analysis through maps. The methodological message of the paper is that while the obvious continuity of catchment process commends catchment scale research into sediment systems, it is difficult to commission especially given an absence of regular sediment monitoring stations in the United kingdom. It is also difficult to convince engineers that it is sensible to seek solutions to local problems of river instability by looking vince engineers that it is sensible to seek solutions to local problems of river instability by looking upstream; time scales are against this approach. The processes of channel storage of sediment are important in this context and deserve fresh attention in field studies. (See also W89-02430) (Author's abstract) W89-02437

SEDIMENT BALANCE CONSIDERATIONS LINKING LONG-TERM TRANSPORT AND CHANNEL PROCESSES,

Northwest Hydraulic Consultants Ltd., Edmonton (Alberta).

IN: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 225-249, 9 fig, 25 ref.

Descriptors: *Geomorphology, *Channel morphology, *Alluvial channels, *Sediment transport, *Channel erosion, Sediment erosion, Runoff, Channel flow, Streamflow, Models, Case studies, Sediment load, Sediment discharge, Meanders.

It is intuitively evident that relationships must exist between long-term bed material transport and sys-tematic channel processes at macro-scale, such as tematic channel processes at macro-scale, such as meander shifting, bar formation and decay, degra-dation and aggradation. Because of the complex-ities of most natural situations, however, progress in practical application of such relationships has been slow. Certain principles and quantitative rela-tionships applicable to selected idealized cases were formulated including: (1) down-valley migra-tion of meanders; (2) channel cross-section changes associated with bar formation and decay; and (3) channel degradation, below dams including the associated with bar formation and decay; and (3) channel degradation below dams including the effect of armoring. Examples are given of actual field situations which approximate to ideal cases and where relationships have been tested to some degree. In the case of systematic meander migration, sediment-balance relationships may be used to tion, secument-paramet renationships may be used.

estimate long-term transport from known sediment transport, or to estimate the effects of the limits of local channel shift from known sediment transport, or to estimate the effects of an altered sediment transport, or to estimate the effects of an altered sediment. or to estimate the effects of an affected sediment transport regime on morphological changes. In the case of channel degradation below dams, sediment-balance considerations lead to interesting conclu-sions about the effect of armoring and the practi-cality of controlling degradation. Such approaches can sometimes provide an independent check on

Erosion and Sedimentation—Group 2J

sediment transport measurements and day-by-day modelling based on sediment transport equations. (See also W89-02430) (Author's abstract)

STATIC ARMOUR LAYERS BY SELECTIVE

STATIC ARMOUR LAYERS BY SELECTIVE EROSION, Canterbury Univ., Christchurch (New Zealand). Dept. of Civil Engineering.
A. J. Sutherland.
IN: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 243-267, 6 fig, 1 tab, 19 ref.

Descriptors: *Sediment transport, *Channel ero-sion, *Channel armoring, *Alluvial channels, scannel armoring, *Alluvial channels, *Sediment erosion, Channel flow, Sediment dis-charge, Mathematical models, Sedimentation, Par-ticle size, Flow velocity, Fluvial sediments.

Selective erosion in an alluvial channel reach for which there is no upstream sediment input can lead to the formation of a static armor layer. Such a layer is at rest, is coarser than the underlying material and inhibits sediment transport from the reach. A review of work on the formation of static armor layers is presented in addressing the issues: (1) under what conditions and by what mechanisms do static armor layers form, and (2) what are the relevant properties of a static armor layers and insims do static armor layers form, and (2) what are the relevant properties of a static armor layer and to what extent can these be predicted. Little progress has been made in quantitatively defining the necessary conditions for armoring. Work has, however, highlighted the major importance of the interplay between the distribution of applied shear stresses and that of the threshold stresses associated with particles in the surface layer. Laboratory observations do allow a qualitative description of the armoring mechanism to be advanced. These are discussed and include the concepts of sheltering and the formation of discrete armoring units which act to protect the sublayers. Prediction methods for static armor layer composition all which act to protect the sublayers. Prediction methods for static armor layer composition all agree that the layer coarsens (median size increases) during the selective erosion process. No such agreement can be found over the shape of the grain size distribution. Both sampling difficulties and the inherently skewed shape of the armor layer distribution are seen as contributing to the confusion that abounds. Examples of single-step and multi-step prediction methods are discussed. (See also W89-02430) (Author's abstract) W89-02439

FORMATION OF A COARSE SURFACE LAYER AS THE RESPONSE TO GRAVEL MO-

BILITY,
Geological Survey, Denver, CO.
E. D. Andrews, and G. Parker.
IN: Sediment Transport in Gravel-Bed Rivers.
John Wiley and Sons, New York. 1987. p 269-325,
13 fig, 37 ref. NSF Grant No. CEE-8311721.

Descriptors: *Alluvial channels, *Sediment transport, *Fluvial sediments, *Bed load, *Particle size, *Gravel, Sediment load, Stream flow, Mathematical models, Case studies, Shear stress.

The concept of hiding is used to discuss the relative mobility of particles of various sizes in poorly sorted fluvial gravel. An analysis of bed load transport in gravel streams indicates that most available port in gravel streams indicates that most available sizes are transported by flow equal to or greater than the mean annual flood. The size distribution of the bed load is similar to that of the subsurface material, which characterizes the bulk of the sediment stored in a river reach. The material on the surface of a gravel-bed stream is, however, typically much coarser than either the bed load or the subsurface material. This coarse surface layer, or pavement, is present even while most available sizes are transported, and is the agent for accomplishing a near-equalization of the mobility of parlishing a near-equalization of the mobility of parsizes are transported, and is the agent for accomplishing a near-equalization of the mobility of particles based on the size distribution of subsurface material. In particular, the relatively greater exposure of large surface particles to the flow eliminates most, but not all, of the differences in mobility between particles of differing sizes. Much of the remaining difference is eliminated by the relative abundance of the coarse particles in the surface compared to the small particles. Thus, the intrinsi-

cally lower mobility of the coarse surface particles is counterbalanced by their greater availability to the flow. Field and laboratory results support this hypothesis. As the bed load transport rate approaches zero, the pavement devolves into an even coarser static armor. (See also W89-02430) (Author's abstract armor. thor's abstract) W89-02440

CANAL DESIGN BY AN ARMOURING PROC-

ESS, Shaw Mont Newfoundland Ltd., St. John's. For primary bibliographic entry see Field 8A. W89-02441

RIVER BED SCOUR AND CONSTRUCTION OF STONE RIPRAP PROTECTION, Northwest Hydraulic Consultants Ltd., North Northwest Hydraulic Consultants Ltd., 1 Vancouver (British Columbia). For primary bibliographic entry see Field 8A. For primary W89-02442

CONCEPTUAL MODELS OF SEDIMENT TRANSPORT IN STREAMS, Oregon State Univ., Corvallis. R. L. Beschta.

Oregon State Only, Corvains.
R. L. Beschta.
IN: Sediment Transport in Gravel-Bed Rivers.
John Wiley and Sons, New York. 1987. p 387-419,
9 fig, 47 ref.

Descriptors: *Alluvial channels, *Model studies, *Sediment transport, *Bed load, *Fluvial sediments, Streamflow, Particle size, Spatial distribution, Temporal distribution, Mathematical models.

tion, Temporal distribution, Mathematical models. The movement of sediment in stream systems is influenced by a wide range of factors including variable source areas of sediment, transient flows, variable particle sizes, nonuniformity of channel geometry and flow, and dynamic/adjusting channels. Variations of suspended sediment concentration are often illustrated in the hysteresis of sediment roating curves, seasonal flushing, effects related to time rate changes in flow and other patterns. A supply-based model is described which is able to reproduce the sediment concentration dynamics of complex storm hydrographs. Although suspended load and bed load are characteristically identified as the two major modes of sediment transport in stream systems, these delineations become indistinct for particles in the range of approximately 0.1-1 mm in diameter. Bed load transport has high temporal and spatial variability, making accurate prediction difficult with hydraulically-based bed load formulae. Part of this variability may be associated with local aggradation and degradation of the bed during high flow events. Research needs are identified that may ultimately improve our capability to predict suspended sediment and bed load sediment transport in streams more accurately. (See also W89-02430) (Author's abstract)

INVESTIGATION OF SEDIMENT ROUTING BY SIZE FRACTIONS IN A GRAVEL-BED

RIVER, Simons, Li and Associates, Inc., Fort Collins, CO. R. M. Li, and W. T. Fullerton. IN: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 421-450, 7 fig, 2 tab, 11 ref.

Descriptors: *Alluvial channels, *Model studies, *Sediment transport, *Particle size, *Stream degra-dation, *Channel erosion, *Fluvial sediments, Mathematical studies, Case studies, Sensitivity analysis, Arizona, Sediment discharge, Sediment erosion, Sediment load, Gravel, Aggradation.

A method of routing sediments by size fraction for computer simulation of channel aggradation and degradation in gravel- and cobble-bed rivers is described. A model using the sediment-routing methodology coupled with the US Army Corps of Engineers' HEC-2 water-surface profile model is presented. The model determines the bed response to the passage of the flood. A case study of the model applied to the Salt River in Phoenix, Arizona, is presented. The case study is used to illustrate

the sensitivity of the procedure to various methods the sensitivity of the procedure to various methods of modelling the armoring process and determining sediment transport rates. Two methods of approximating the armoring process, in addition to different sediment transport relationships, are used to determine sediment transport rates. (See also W89-02430) (Author's abstract)

BED LOAD DISCHARGE EQUATIONS FOR STEEP MOUNTAIN RIVERS,

Newcastle upon Tyne Univ. (England). Dept. of Civil Engineering. J. C. Bathurst, W. H. Graf, and H. H. Cao. IN: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 453-491, 8 fig, 5 tab, 55 ref.

Descriptors: *Sediment discharge, *Fluvial sediments, *Sediment transport, *Alluvial channels, *Bed load, Particle size, Shear stress, Flow velocity, Sediment load, Slopes, Model studies.

Data collected in steep flumes and rivers are used to identify existing bed load discharge equations which are appropriate to mountain rivers with coarse sediment. Flume data contributed by this study consist of measurements of flow parameters, sediment discharge and bed form development for flows over three different sediment beds (D50 = 11.5, 22.2 and 44.3 mm) at a variety of slopes (8 = 0.5 to 9%) and unit water discharges (q = 0.017 to 0.417 sq m/sec). Combined with other flume and field data they show that initiation of bed load transport can be predicted by the Schoklitsch approach (based on critical water discharge), modified to allow for the effect of non-uniform sediment size distribution. However, for sediments ment size distribution. However, for sediments with wide size distributions the initiation of motion with wide size distributions the initiation of motion may not involve movement of all available sizes. The familiar Shields approach (based on constant dimensionless shear stress) is found to fail at slopes S is greater than or equivalent to 1% and relative submergences d/D50 is less than or equivalent to 10. For bed load discharge, tests of the equations of Ackers and White, Meyer-Peter and Muller, Smart, Mizuyama, Bagnold and Schoklitsch show that the Schoklitsch equation provides the most accurate predictions for the flume data. This is partly because it does not explicitly involve depth, a variable which is difficult to measure accurately in steen. rough flows. Tested against river data the a variable which is difficult to measure accurately in steep, rough flows. Tested against river data the Schoklitsch equation applies with order of magnitude accuracy where sediment availability is unlimited (typically in channels with slopes where S is nted (typically in channels with slopes where S is less than or equivalent to 1%). However, it significantly overpredicts sediment discharge in the smaller mountain rivers where sediment availability is determined by sediment size distribution and external supply effects. (See also W89-02430) (Author's abstract)
W89-02445

FIELD MEASUREMENTS IN A GRAVEL-BED RIVER WHICH CONFIRM THE THEORY OF WHITE ET AL., Ministry of Works and Development, Christ-church (New Zealand). Hydrology Centre.

S. M. Thompson.

In: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 493-509, 6 fig, 3 tab, 12 ref.

Descriptors: *Alluvial channels, *Channel morphology, *Sediment transport, *Channel erosion, *Bed load, *Mathematical models, Sediment erosion, Gravel, Fluvial sediments, Sediment load, Flow velocity, New Zealand, Theoretical analysis, Sediment discharge.

Field measurements of channel geometry, water velocity and bed load in the Ohau River offer favorable comparisons with the theory of White, Bettess and Paris. The measurements were of many Bettess and Paris. In emeasurements were of many channels formed by flows of up to 500 cu m/sec in gravel whose median particle size is D = 0.02 m and grading is D84/D = 3.5, on a flood plain slope of 0.006. The bed load in the river was estimated from measurement of delta accretion. The theory describes the process of enlargement of branch

Group 2J-Erosion and Sedimentation

channels in this braided river. The field measure ments in the Ohau River have confirmed the theory of White et al. remarkably well, although by were made for another purpose. As the bed or aks of a branch channel erode or accrete, the banks of a branch channel erode or accrete, the channel shape develops towards that predicted by the theory but various factors limit its spatial extent and temporal persistence, such as: (1) reduced inflow of water as the river flow declines or another branch captures the flow; (2) increased inflow of sediment carried by relatively small transverse inflows of water down the steep sides of the channel; and (3) reduced outflow of sediment either because the downstream water level rises or because an obstruction such as a tree lodges in the channel. In the complex morphology of the braided Ohau River, the channels conforming to the theory of White et al. are the deepest and occupy the lowest points on the bed. The theory is applicable to all parts of the river bed, although, at any the lowest points on the bed. In a theory is appricable to all parts of the river bed, although, at any particular time during a flood, only a small part of the bed is occupied by flows in branch channels with the theoretical proportions. (See also W89-02430) (Geiger-PTT) W89-02440.

MOUNTAIN TORRENT EROSION,

Kyoto Univ. (Japan). Disaster Prevention Re-search Inst.

R. Ashida.
IN: Sediment Transport in Gravel-Bed Rivers.
John Wiley and Sons, New York. 1987. p 513-544,
14 fig, 17 ref.

Descriptors: *Sediment transport, *Bank erosion, *Alluvial channels, *Channel erosion, *Erosion ontrol, Sediment load, Sediment discharge, Streamflow, Flow velocity, Shear stress, Bed load, Streamflow, Flow vel Mathematical models.

The dynamic behavior of a soil block released by a slope failure is discussed first, by using mass and momentum equations; the calculation of the critical slopes for the initiation and cessation of motion and slopes for the initiation and cessation of motion and the calculation of the transport velocity as well as the runout distance of the soil block are also presented. A soil block will be crushed into grains by the shearing force due to gravity during its movement and will become transformed into a debris flow under the conditions that enough water to fill flow under the conditions that enough water to fill the increased void space is supplied and that the channel alope is steep enough to provide the propelling force. The mechanics of a debris flow at its onset and during flow are outlined, and the side bank erosion of a stream channel composed of sand-clay mixtures is addressed. The critical shear stress for movement of sand particles within mixtures is discussed by introducing a cohesive force acting among particles into the dynamic balance equation. A theoretical method for evaluating the critical shear stress is presented for particles in cohesive and non-cohesive materials on both the bed and side slope, and the pickup rate of sediment particles within cohesive material beds is formulated. The eroding process of stream channels is discussed. It is shown that the erosion rate can be evaluated by integration of the pickup rate for sand evaluated by integration of the pickup rate for sa particles along the entire stream bank. A formula for predicting the bank erosion rate for both non-cohesive and cohesive materials is derived. Erosion and debris flow control by structures is outlined. (See also W89-02430) (Author's abstract) W89-02447

SEDIMENT TRANSPORT IN STEP-POOL

STREAMS,
Ministry of Works and Development, Lower Hutt
(New Zealand). Central Labs.
J. G. Whitaker.
IN: Sediment Transport in Gravel-Bed Rivers.
John Wiley and Sons, New York. 1987. p 545-579,

Descriptors: *Alluvial channels, *Channel erosion, *Model studies, *Sediment transport, *Fluvial sediments, *Channel morphology, Sediment erosion, Mathematical models, Weirs, Scour, Streams, Sediment load, Bed load.

The step-pool structure characteristic of some steep mountain streams is described and three step

types differentiated. A review of observations on sediment transport in step-pool streams is present-ed. Sediment for transport is derived from a few localized sites in the stream's catchment and inputs into the stream are usually of a bulk or unsteady nature. Sediment tends to be moved through steppool streams as waves. The mechanism of transpool streams as waves. The mechanism of trans-port at the scale of a step-pool unit is dictated by the step-pool morphology. Tests are described in which step-pool systems were modelled by a suc-cession of discrete weirs. Results are presented for the clear water scour between the steps and on the clear water scour between the steps and on steady sediment transport through such an idealized step-pool system. A model based on these results is presented which predicts the transport through a step-pool system following an unsteady input of sediment. Predictions of the model confirm the observation made in natural step-pool streams of sediment moving in long, low waves. (See also W89-02430) (Author's abstract) W89-02448

BED LOAD TRANSPORT MEASUREMENTS BY THE VORTEX-TUBE TRAP ON VIRGINIO CREEK, ITALY.

Florence Univ. (Italy). Dept. of Civil Engineering. For primary bibliographic entry see Field 7B. W89-02449

BED LOAD TRANSPORT IN DESERT FLOODS: OBSERVATIONS IN THE NEGEV, Hebrew Univ., Jerusalem (Israel). Inst. of Earth

A. P. Schick, J. Lekach, and M. A. Hassan. In: Sediment Transport in Gravel-Bed Rivers.
John Siley and Sons, New York. 1987. p 617-642, 7 fig, 4 tab, 25 ref.

Descriptors: *Sediment transport, *Bed load, *Deserts, *Alluvial channels, Fluvial sediments, Tracers, Sediment load, Alluvial rivers, Floods, Israel, Scour, Sediment erosion.

Sediment transport in the small, extremely arid, high-relief catchment of Nahal Yael in the Southern Negev, Israel has been investigated over the night-relief catchment of Nanai rate in the South-ern Negev, Israel has been investigated over the last twenty years by field and laboratory studies. Coarse bed load provides one-half or more of the long-term sediment yield of Nahal Yael. Pebbles and cobbles are transported, in significant events, over distances of 15-100 m per event, with little dependence on size and a large variation between individual particles. The important effect of high-magnitude, low-frequency events on the bed load transport in desert floods also in larger catchments has been confirmed in the study of the Wadi Mikei-min (Sinai) alluvial fan, which has been deposited in a mid-mountain stream junction by a 100 year flood. Sampling of total sediment load in an upland tributary of Nahal Yael during the 4 hour long event 12A enabled an analysis which suggests that bed load transport in channels devoid of alluvial cover occurs in pulses (waves) unrelated to water discharge characteristics, but may reflect an intrindischarge characteristics, but may reflect an intrin-sic feature of catchment dynamics. The regular spacing of pools and riffles and of gravel bars in alluvial reaches further downstream may therefore anuviar reaches further downstream may incretore be initiated from upstream. Detailed three-dimensional analysis of the bed load as deposited in the Nahal Yael reservoir by events 15 and 16 indicated deposition by a pulsating mechanism, with pebbly material overlying finer grained deposits. Numerous cobble have been deposited on top of the sediment column in the reservoir. A tracing program of labelled coarse bed load has been in oper-ation in Nahal Yael since 1965. Particles that travel ation in Nanal Yael since 1905. Particles that travel the greatest distance appear to have been buried at one time or another during their downstream journey. Drawbacks of the tracing method, especially the inability to locate particles completely embedded in the scour layer, have prompted a search for alternatives. The method ultimately selected and successfully employed in Nahal Hebron is based on progressic locality. magnetic labelling. Detection is possible to a depth of up to 60 cm. This resulted in a significant increase of the recovery rate from about 50 to 95% per flood event. (See also W89-02430) (Author's abstract) W89-02450

INFLUENCE OF LARGE SUSPENDED-SEDI-MENT CONCENTRATIONS IN RIVERS.

Colorado State Univ., Fort Collins. Dept. of Civil Engineering.

J. B. Bradley, and S. C. McCutcheon.

IN: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 645-689, 11 fig. 3 tab, 62 ref.

Descriptors: *Alluvial channels, *Mud flows, *Bed load, *Suspended load, *Sediment transport, Suspended sediments, Channel erosion, Sediment load, Flow velocity, Sedimentation, Case studies, Sediment erosion, Sediment discharge, Mathematical

The need to understand and predict flows that carry large sediment loads has become acute in the United States over the past few years. In part, this results from intensified land development and urresults from intensified land development and ur-banization of less desirable land on or near steep slopes. Subsequently, flows with large concentra-tions of suspended sediment have caused extensive property damage and loss of life during recent years in the San Francisco Bay area, in the Wa-satch Mountains of Utah, and near volcanic Mount St. Helens. To aid in the understanding of these flows, ways of classifying such flows are explored, and variations in fluid and sediment properties, resistance and transport in open channel velocity, resistance, and transport in open-channel flows is described. Over the full range, classifica-tion by sediment content is of limited use. Changes in fluid and sediment properties are not well underin titud and securimen properties are not well understood for the more concentrated flows. Also methods to predict velocity, resistance, transport, and morphology are not well developed. A case history of the Mount St. Helens sedimentation problem is presented to illustrate some of these shortcomings. (See also W89-02430) (Author's abstract) W89-02451

SUSPENDED LOAD IN RIVERS: UK EXPERIENCE, GRAVEL-BED

RIVERS: UN EXPENDENCE,
Exeter Univ. (England). Dept. of Geography.
D. E. Walling, and B. W. Webb.
IN: Sediment Transport in Gravel-Bed Rivers.
John Wiley and Sons, New York. 1987. p 691-732,
11 fig, 8 tab, 54 ref.

Descriptors: *United Kingdom, *Suspended sediments, *Sediment load, *Suspended load, *Alluvial channels, *Sediment transport, Mathematical models, Bed load, Gravel, Sediment yield, Clay, Silt, Sediment erosion, Model studies.

In the absence of a national suspended-sediment monitoring network, results from localized re-search investigations have been collated to make search investigations have been collated to make some generalizations concerning suspended sediment transport by United Kingdom (UK) rivers. Annual yields are low by world standards and range from < 1 to nearly 500 tons/sq km/yr. Suspended sediment concentrations in British rivers are also relatively low, rarely exceeding 5000 mg/l and often not rising above 500 mg/l. Relatively little information is generally available. Relatively little information is generally available on the properties of suspended sediment in the UK, but existing data suggest that silt (2-62 microns) and clay (< 2 microns) fractions dominate particle-size distributions and that the organic matter content is typically 10-30%. More detailed discussion of suspended-sediment dynamics of gravel bed rivers in Britain is based on the results from a seventeen-year investigation of the River Exe (1500 sq km) in Devon. Manual sampling and (1500 sq km) in Devon. Manual sampling and continuous recording via photoelectric turbidity meters at thirteen sites within this catchment have indicated that suspended sediment concentration dynamics are characterized by indicated that suspended-sediment concentration dynamics are characterized by seasonal and storm-period hysteresis, and that sediment transport is more strongly influenced by sediment availability than by transport energy. Detailed sediment data have stressed the importance of time-variant sediment supply and have also been used to show that ment supply and nave also been used to snow that traditional procedures for calculating sediment transport, based on the construction of rating curves from infrequent samples, may produce esti-mates lacking in both accuracy and precision. Problems of estimating sediment yield reflect the bias of transport towards episodic high flows and magnitude and frequency analyses indicate that

Erosion and Sedimentation—Group 2J

50% of the suspended-sediment load is removed in only 0.2% of the study period at some sites. (See also W89-02430) (Author's abstract) W89-02452

ENERGY DISSIPATION RATE APPROACH IN RIVER MECHANICS, Bureau of Reclamation, Denver, CO. Engineering and Research Center.

and research Center. C. T. Young. IN: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 735-766, 6 fig, 3 tab, 45 ref.

Descriptors: *Sediment transport, *Alluvial chan-nels, *Sediment discharge, *Channel morphology, *Energy dissipation, Sand, Gravel, Flow friction, Mathematical models, Theoretical analysis.

The rate of energy dissipation of flowing water in a natural river should be related to the rate of work being done in transporting sediment and forming the channel geometry and profile. This concept can be applied to the development of sediment transport equations and the determination of alluvial channel geometry and profile. There are two schools of thought on the application of this concept to sediment transport. The stream power approach uses the power dissipation per unit bed area, while the unit stream power approach refers approach uses the power dissipation per unit bed area, while the unit stream power approach refers to the power dissipation per unit weight of water. A review and evaluation of equations derived from the two concepts is made to determine their applications to sand and gravel transport. The theory of minimum rate of energy dissipation and its simplified versions can be applied to explain the variation of channel geometry and profile. There are different means by which a river can minimize its rate of energy dissipation. These include, but are not limited to, the adjustment of roughness, sediment discharge, channel geometry and profile. A review and comparison of the extremal theories and hypotheses based on minimum rate of energy dissipapotheses based on minimum rate of energy dissipa-tion, maximum sediment discharge and maximum friction factor is made to evaluate the relationships between them and their limits of applications. (See also W89-02430) (Author's abstract) W89-02453

EXTREMAL HYPOTHESES APPLIED TO RIVER REGIME.

Hydraulics Research Ltd., Wallingford (England). R. Bettess, and W. R. White.

R. Bettess, and w. K. Write. IN: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 767-789, 3 fig, 21 ref. Department of the Environment (UK) Contract PECD 7/6/29-204/83.

Descriptors: *Sediment transport, *Alluvial chan-nels, *Channel morphology, *Sediment erosion, Mathematical models, Sediment load, Bed load, Sediment erosion, Theoretical analysis, Stream-flow, Flow friction, Energy dissipation, Gravel,

Regime theories are used to predict the shape of stable alluvial channels. The first such theories were entirely empirically based on extensive field measurements. Recent developments in our knowledge of sediment transport processes in alluvial edge of sediment transport processes in alluvial channels, however, have introduced the possibility of developing regime theories based on equations describing these fundamental processes. Frequently an extremal hypothesis, such as minimum stream power or maximum sediment concentration, is invoked to enable the complete system to be determined. It is assumed that the channel dimensions exhibit to expend the procession of the complete system to be determined. adjust to maximize or minimize the value of some appropriate functional. Various proposed extremal hypotheses are discussed and their predictions in terms of channel shape are compared. The effect of using the various hypotheses with different sedi-ment transport relationships is also considered. (See also W89-02430) (Author's abstract)

PROBLEMS OF BED LOAD TRANSPORT IN

BRAIDED GRAVEL BED RIVERS, Lincoln Coll., Canterbury (New Zealand). Dept. of Agricultural Engineering.

T. R. H. Davies. IN: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 793-828,

Descriptors: *Alluvial channels, *Model studies, *Channel morphology, *Sediment transport, *Bed load, *Sediment load, Sediment erosion, Mathematical models, Stochastic process, Numerical analysis, Gravel, Model studies, New Zealand.

Braided gravel-bed rivers are important for agriculture, hydropower, fisheries, recreation and the environment in New Zealand. These values are sensitive to the braided character of the river, which is strongly related to bed load transport. Bed load and morphological changes due to engineering or other development must be predicted before the river's response can be evaluated and detrimental repercussions minimized. The major problems are associated with the measurement and evaluations of bod in the contribution of the contribution production of bed load transport rate and river morphology. These problems are underlain by the fundamental difficulty of describing the variability of the system. Previous field studies indicate massive variability in the hydraulic characteristics of braided rivers, with few clear trends. Bed load sive variations, in the hydraulic characteristics of braided rivers, with few clear trends. Bed load calculations have previously been based on point measurements, sediment budgets and stochastic data input to a bed load equation; relative bed load capacity has also been related to total stream power. Prototype bed load data to test these calculations are very sparse and unreliable due to sampling difficulties. The feasibility of modelling the hydraulic processes characteristic of braided rivers has been demonstrated by laboratory studies, however. Conventional bed load prediction methods fail due to the huge quantity of field data needed to describe the distribution of depths, slopes, velocities and sediments in a braided river. Bed load may correlate in black-box fashion with total stream power, but hydraulic variability is likely to influence this correlation. Stochastic input data generation needs a large body of field data to establish the statistical data parameters with characteristic scale statistical data parameters with characteristic scale modelling, apparently the only possible way to acquire realistic bed load data. Quantification of acquire realistic bed load data. Quantification of river behavior may be achieved using numerical data on channel, or bar, pattern evolution from digital image analysis. This, the only readily recorded braided river parameter, might be a useful surrogate for morphological variation, and might be used to calibrate a black-box bed load predictor if model bed load data and channel patterns are shown to be realistic. (See also W89-02430) (Author's abstract) thor's abstract) W89-02455

INTERACTION OF BED LOAD TRANSPORT WITH BARS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
M. N. R. Jaeggi.
IN: Sediment Transport in Gravel-Bed Rivers.
John Wiley and Sons, New York. 1987. p 829-841, 7 fig, 28 ref.

Descriptors: *Alluvial channels, *Sediment transport, *Bed load, *Channel morphology, River beds, Mathematical models, Numerical analysis, Fluvial sediments, Sediment load, Flow friction, Flow velocity, Model studies.

In gravel-bed rivers the bed material moves only as bed load. From laboratory experiments it is gener-ally accepted that the material which is transport-ed as bed load constitutes a layer which is one grain size thick. In prototype rivers the transport-mechanism may be similar to that in narrow (usualmechanism may be similar to that in narrow (usual-ly artificially trained) channels which possess plane beds. However, many of these channels exhibit the well known feature of alternate bars. In such rivers there is a strong interaction between bar migration and bed load transport. Since a similar interaction exists in natural braided or meandering channels, the effect of alternate bar formation on bed load transport can be taken to be a model of the more expertal process. It is important to know for which general process. It is important to know for which channels bar migration may affect the bed load transport rate. Criteria for predicting alternate bar formation have been developed which are func-

tions of channel geometry, flow parameters and bed material characteristics. The effect of bar formation on flow resistance is discussed, since form resistance reduces transport capacity. Bar migration rates and bar height are correlated to at least part of the bed load transport rate. Bar height is basically a function of channel width and grain size. Bar migration rate is a parameter which can easily be detected in the prototype. Part of the bed load moves along the channel thalweg without affecting bar migration. However, only the part involved in bar migration should be seen as an indicator of river bed changes. Since bars are also sediment storage areas, and bar height influences bed load transport velocity, bar formation may have to be considered in the numerical modelling of rivers. (See also W89-02430) (Author's abstract) W89-02456 W89-02456

RESERVOIR SEDIMENTATION AND INFLU-ENCE OF FLUSHING,

P. Ackers, and G. Thompson

IN: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 845-868, 5 fig, 13 ref.

Descriptors: *Sedimentation, *Sediment transport, *Silting, *Reservoir silting, *Flushing, Sediment erosion, Numerical analysis, Mathematical models, Developing countries, Case studies, Reservoir op-eration, Erosion control.

There are many reservoirs which can no longer perform their design function because much of their original live storage volume has been filled by sediment. Detailed consideration of reservoir sedimentation is needed, in respect to both existing and proposed reservoirs, to predict the loss of available storage as a function of time, the distribution of deposition and the prospects of extending the effective life of the project by flushing through low-level outlets. Such sediment studies have to be integrated with economic and operational studies of the project to determine an acceptable flushing routine. Investigation of reservoir sedimentation of the project to determine an acceptable flushing routine. Investigation of reservoir sedimentation can be at several levels of detail, starting from basic consideration of mean annual sediment supply in relation to reservoir volume, through empirical methods of assessing trap efficiency, to sophisticated computational modelling of the full operation routines with varying flows, a range of sediment sizes and functions for sediment transport, deposition and erosion. The available methods are reviewed and set out in the context of case studies. Examples of sediment yield curves illustrate the need for reliable field information on sediment supply. The role of mathematical and trate the need for reliable field information on sediment supply. The role of mathematical and physical models is explained, including recent developments of numerical simulations and their application to reservoirs in Pakistan, Algeria and elsewhere. The practical problems arising from reservoir sedimentation are explained by reference to examples and case studies, including: (1) loss of storage and consequent loss of yield; (2) increased upstream flooding; (3) blockage of intakes; (4) abrasion of turbines; (5) impact on downstream river regime. The way in which sluicing through low-level outlets may be used to mitigate these adverse effects is examined in the framework of operational and economic criteria, taking account of changes and economic criteria, taking account of changes and economic criteria, taking account of changes in reservoir level and loss of output from hydro-power. (See also W89-02430) (Author's abstract) W89-02457

DESIGN PROBLEMS IN GRAVEL-BED RIVERS, ALASKA,

BAYERS, ALASBA,
HArza Engineering Co., Chicago, IL.
B. H. Wang, S. R. Bredthauer, and E. A.
Marchegiani.
IN: Sediment Transport in Gravel-Bed Rivers.
John Wiley and Sons, New York. 1987. p 869-894,
6 fig, 4 tab, 23 ref.

Descriptors: *Sediment transport, *Hydroelectric plants, *Channel erosion, *Alluvial channels, *Reservoir silting, *Dam effects, *Alaska, Gravel, Bed load, Sediment load, Environmental effects, Environmental impact statement, Sedimentation, Dam design, Aggradation, Erosion control.

Group 2J-Erosion and Sedimentation

Design problems in gravel-bed rivers in Alaska are discussed using the Susitna Hydroelectric Project on the Susitna River and the Galena Erosion Control Project on the Yukon River as examples. The anticipated construction and operation of the anticipated construction and operation of the Watana and Devil Canyon dams on the Susitna River will significantly change the flow regime and perturb the existing conditions of the river. A study has been made to estimate potential deposition of sediments in the reservoirs for the reach upstream from the dams. Results indicate that sediupstream from the cames. Results indicate that secu-mentation in the reservoirs will not significantly reduce their useful capacity within 100 years of operation. For the reach downstream from the dams, studies were made to estimate potential deg-radation and aggradation. Results indicate that radation and aggradation. Results indicate that there would be minor degradation for the 50 mile reach between Devil Canyon and the confluence with a major glacial tributary, the Chulitan River, and that there would be some aggradation down-stream from the confluence. Other problems dis-cussed include seepage and piping, abrasion of concrete surface and hydromachineries, sedimentaconcrete surface and hydromachineries, sedimentation in diversion tunnels and effects on tailwater by aggradation and degradation. Erosion control structures are being extended upstream on the Galena River to prevent flanking of structures built in the early 1960s, and to extend protection to a new town site. The major erosion process appears to be niching and slumping of the upper bank. The long-term erosion rate through the bend is relatively constant, averaging 3-5.5 m/yr over the period from 1963 to 1983. However, a combination of waves and high water has caused erosion nation of waves and high water has caused erosion rates of up to 13.7 m in 3 days. An analysis of rates of up to 13.7 m in 3 days. An analysis of erosion processes occurring along the bend has been conducted for the period from break-up to freeze-up. The effects of permafrost and massive ice have also been assessed. Erosion control structures have been designed for the transition area between the existing structure (no erosion) and the natural bank (about 3.6-4.6 m/yr of erosion). A feasibility study is being conducted to determine the optimum design for extending the structures further upstream. (See also W89-02430) (Author's W89-02458

TIME-VARYING STOCHASTIC MODEL OF THE FREQUENCY AND MAGNITUDE OF BED LOAD TRANSPORT EVENTS IN TWO SMALL TROUT STREAMS,

Freshwater Biological Association, Ambleside

P. A. Carling, and M. A. Hurley.

In: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 897-920, 7 fig, 4 tab, 26 ref.

Descriptors: *Alluvial channels, *Model studies, *Bed load, *Sediment transport, *Sediment erosion, *Stochastic process, Mathematical models, Channel morphology, Runoff, Poisson ratio, Regression analysis, Model studies, Streams, United Kingdom.

In gravel-bedded streams in the Pennine uplands of In gravel-bedded streams in the Pennine uplands of the United Kingdom most bed load movement occurs episodically during short discrete runoff events. A two-part model is fitted to the frequency and magnitude of bed load mass-transport events in two small trout streams. A time-varying Poisson process is fitted to event timings, with Poisson rate varying continuously in a seasonal pattern supering posed upon an overall decline symptomatic of short-term climatic change. Event magnitude is described by a regression model containing stream short-term climatic change. Event magnitude is described by a regression model containing stream peak discharge and an autoregressive moving average error structure. The two-part model is fitted initially to data from one stream and its general applicability tested by refitting it to data from the second stream. With some minor reservations, the model fits well the data from both streams. The model fits well the data from both streams. The resultant model parameters and the variables considered in formulating the model are interpreted, where applicable, within a geomorphological context. Important ecological consequences and the possibilities for future development of predictive models are also discussed. (See also W89-02430) (Author's abstract) W89-02459

CASE STUDY OF MINIMUM STREAMFLOW FOR FISHERY HABITAT IN THE YAMPA RIVER,

Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. S. O'Brien.

IN: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 921-946, 11 fig, 1 tab, 21 ref.

Descriptors: *Instream flow demand, *Alluvial channels, *Fisheries, *Minimum flow, *Colorado, *Sediment load, *Sediment transport, Mathematical models, Streamflow, Case studies, Discharge hydrographs, Sand, Sediment discharge, Aquatic habitats.

The U. S. Department of the Interior initiated studies in 1982 to determine a minimum streamflow studies in 1982 to determine a minimum streamflow that would maintain the existing aquatic habitat in the Yampa River in Dinosaur National Monument, Colorado. The study focused on the habitat needs of the endangered Colorado squawfish (Ptcyhocheilus lucius) which spawned in a short reach of the river. The concern for habitat maintenance arose from the realization that a possible reduction or alteration in the existing flows may result in a arose from the reauzation that a possible reduction or alteration in the existing flows may result in a change of substrate conditions required for suc-cessful Colorado squawfish reproduction. The con-cept of a minimum streamflow hydrograph was proposed to preserve the existing cobble substrate in the presence of the substantial sand load transported by the river. Ideally, a minimum stream-flow hydrograph should encompass a range of discharges which will transport the bulk of the annual sediment load, inundate the active channel area, maintain the existing substrate characteristics and sustain the dynamic processes forming the integral features of the channel. The minimum streamflow hydrograph for the Yampa River was streamflow hydrograph for the Yampa River was designed from the results of a two-year field data collection program, a physical model, laboratory simulation of flows on a cobble substate and a mathematical model simulation of sediment transport. Its components included: a baseflow of 367 cu ft/sec (10 cu m/sec), rising and recessional limbs, and a peak discharge of 11,500 cu ft/sec (325 cu m/sec). Investigations of cobble mobilization and sand transport processes over coarse-grained substrate were conducted during the study. The long-term effects of reduced discharge on critical habitat are discussed. (See also W89-02430) (Author's abstract) thor's abstract) W89-02460

ESTIMATING THE TRANSPORT AND DEPO-SITION OF MINING WASTE AT OK TEDI, Ok Tedi Mining Ltd., Port Moresby (Papua New

Guinea).
R. J. Higgins, G. Pickup, and P. S. Cloke.
IN: Sediment Transport in Gravel-Bed Rivers.
John Wiley and Sons, New York. 1987. p 949-976,
4 fig. 5 tab, 25 ref.

Descriptors: *Sediment transport, *Mine wastes, *Sediment discharge, *Path of pollutants, Sediment load, Model studies, Sedimentation, Algorithms, Suspended sediments, Hydrological data

Since its earliest days, the Ok Tedi mining project has been influenced by, and has had an influence on, the sediment transport loads and capacities of streams in the area. Initial assessments were based streams in the area. Initial assessments were based on very limited information on both the natural system and the project development plans. Against a background of on-going data collection efforts successive assessments have utilized an improved understanding of the natural system and contributed to an improved definition of development scenarios. A wide range of river characteristics is encountered in and downstream of the mine area. In addition, it has been necessary to make decisions between the benefits of sophisticated methods and the poor quality of input data. An examination of the various assessments reveals the need to mainthe various assessments reveals the need to main-tain flexibility in the selection of methods, carefully matching transport equations and computational algorithms to the reach characteristics, the data available and the purpose of the assessments. The experience of sediment transport assessments at Ok Tedi provides guidelines for the application of

methods based on sediment characteristics, representative reaches, sediment routing routines and physical modelling. (See also W89-02430) (Auor's abstract) W89-02461

MODELLING FLUVIAL PROCESSES IN STREAMS WITH GRAVEL MINING, San Diego State Univ., CA. Dept. of Civil Engineering neering. For primary bibliographic entry see Field 2E. W89-02462

SEDIMENT DISCHARGE DATA FOR THE LOWER REACH OF CAMPBELL CREEK, ANCHORAGE, ALASKA: MAY TO SEPTEMBER

Geological Survey, Anchorage, AK. Water Resources Div.

Sources Div.

S. W. Lipscomb.

Available from OFSS, USGS, Box 25425, Denver,
CO 80225. USGS Open-File Report 88-81, 1988.

12p, 3 fig, 5 tab, 6 ref.

Descriptors: *Sediment discharge data, *Urban runoff, Bridge design, Suspended sediment, Alaska, Anchorage.

Streamflow and suspended-sediment data were collected at three sites, two upstream and one downstream from the proposed bridge construction site in Anchorage, Alaska. Immediately downstream from the study reach, the creek enters Campbell Lake, an artificial impoundment in which sedimentation is becoming of concern to recreational users and lakeside residents. (USGS) W89-02496

VERTICAL PROFILES OF VELOCITY AND SUSPENDED SEDIMENT IN STREAMS NEAR MOUNT ST. HELENS, WASHINGTON, Geological Survey, Vancouver, WA. Water Resources Div.

R. L. Dinehart. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-377, 1987. 140p, 5 fig, 1 tab, 12 ref.

Descriptors: *Suspended load, *Vertical distribu-tion, *Velocity, *Sediment concentration, *Volca-noes, Sediment distribution, Mount St. Helens, Washington.

Vertical profiles of high suspended-sediment con-centrations and high velocities in stream near Mount St. Helens were measured between January 1981 and May 1986 at seven gaging stations. Data-collection methods are described and the numeri-cal data are tabulated and plotted. Values for the exponent of the sediment-distribution equation were computed for several sand-size ranges using the least sources method. Logarithms of concentrawere computed for several sand-size ranges using the least squares method. Logarithms of concentration of a size class at various depths (y) are plotted versus the logarithms of D-y/y (D = flow depth). The ratio of point velocity to mean velocity is plotted versus normalized depth. Selected plots of the logarithms of concentration of fine sand (0.125 to 0.250 millimeters) versus promplized depth. hibited visual management of the logarithms of concentration of fine sand (0.125 to 0.250 millimeters) versus normalized depth (height above streambed/depth) show the vertical distribution of a predominant sediment-size range. (USGS) W89-02523

HYDROLOGIC DATA FOR COMPUTATION OF SEDIMENT DISCHARGE, TOUTLE AND NORTH FORK TOUTLE RIVERS NEAR MOUNT ST, HELENS, WASHINGTON, 1980-84. Geological Survey, Vancouver, WA. Water Re-For primary bibliographic entry see Field 7C. W89-02571

SEDIMENT-DATA SOURCES AND ESTIMAT-ED ANNUAL SUSPENDED-SEDIMENT LOADS OF RIVERS AND STREAMS IN COLO-

RADO, Geological Survey, Denver, CO. Water Resources

Erosion and Sedimentation—Group 2J

DIV.
J. G. Elliott, and K. L. DeFeyter.
Available from OFSS, USGS, Box 25425, Denver,
CO 80225. USGS Water Resources Investigations
Report 86-4344, 1986. 148p, 2 plates, 138 tab, 31

Descriptors: *Colorado, *Sediment data, *Annual suspended load, *Sediment transport, Data collections, Hydrologic data, Regression analysis.

Sources of sediment data collected by several government agencies through water year 1984 are summarized for Colorado. The U.S. Geological Survey has collected suspended-sediment data at 243 sites; these data are stored in the U.S. Geological Survey's water data storage and retrieval system. The U.S. Forest Service has collected suspended-sediment and bedload data at an additional 225 sites, and most of these data are stored in the U.S. Environmental Protection Agency's water-quality-control information system. Additional unpublished sediment data are in the possession of the collecting entities. Annual suspended-sediment loads were computed for 133 U.S. Geological Survey sediment-data-collection sites using the daily mean water-discharge/sediment-transport-curves were derived for each site by one of three techniques: (1) Least-squares linear regression of all pairs of suspended-sediment and corresponding water-discharge data, (2) least-squares linear regression of data sets subdivided on the basis of hydrograph season; and (3) graphical fit to a logarithm-logarithm plot of data. The curve-fitting technique used for each site depended on site-specific characteristics. Sediment-data sources and estimates of annual loads of suspended, bed, and total sediment from several other reports also are summarized. (USGS)

CONTRIBUTION TO COMPUTATION OF SEDIMENTATION OF SOLIDS IN HORIZON-TAL-SEDIMENTATION BASINS (EIN BEITARG ZUR BERECHNUNG DER SEDIMENTATION VON FESTSTOFFEN IN HORIZONTAL DURCHSTROMTEN SANDFANGEN), Hochschule der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Wasserwesen. For primary bibliographic entry see Field 5D. W89-02711

APPLICATION OF CS-137 TECHNIQUES TO PROBLEMS OF SEDIMENT REDISTRIBUTION IN SUNGAI LUI REPRESENTATIVE BASIN, SELANGOR, MALAYSIA: PART I. Unit Tenaga Nuklear, Bangi (Malaysia). Available from the National Technical Information Service, Springfield, VA. 22161, as DE87-701594. Price codes: A02 in paper copy, A01 in microfiche. November 1982. 5p, 2 fig, 1 tab, 2 ref. IAEA Regional Cooperative Agreement MAL 2623/RI/AG.

Descriptors: *Sediment transport, *Sediment distribution, *Cesium radioisotopes, *Radioactive tracers, Radioisotopes, Tracers, Soil profiles, Malaysia, Tracers, Silting.

Insurance, Smith B.

Since the beginning of the nuclear age, Cesium-137 (137-Cs) has become part of the world's ecosystem. 137-Cs has become part of the world's ecosystem. 137-Cs is produced by nuclear explosions, and is carried from the atmosphere to ground by rainfall. On reaching the earth's surface, 137-Cs becomes strongly adsorbed in soil profiles and is concentrated predominantly in the surface layer, particularly in clayey soils. Systematic measurements of 137-Cs levels allow for accurate estimates to be made of the cumulative effects of soil redistribution over the past 25 years. 137-Cs activities in soils ranged from 1.3 to 6.8 MBq/gm sample and they could still be detected even up to 20 cm depth. The highest activity of 137-Cs was observed at locations at about 3 cm depth. On the basis of this result, an estimated rate of sediment-accumulation in the area was calculated to be about 0.53 cm/year. (Lantz-PTT)

EROSION AND SEDIMENTATION,

Exeter Univ. (England). Dept. of Geography.

Exeter Univ. (England). Dept. of Geography.
B. W. Web).
IN: Hydrology 2000. International Association of
Hydrological Sciences, Inst. of Hydrology, Wallingford, England. IAHS Publication No. 171,
1987. p 51-62.

Descriptors: *Erosion, *Sedimentation, *Research priorities, Hydrologic studies, Rivers, Channel ero-sion, Sediment transport, Solute transport, Denu-dation, Future planning.

The development erosion and sedimentation stud-ies up to the present is reviewed and likely future research activities are discussed. Previous studies have involved suspended and dissolved substance have involved suspended and dissolved substance transport by rivers, mass movements (slides, debris flows), and models to predict upland erosion. In the future more basic data on erosion and sedimentation will be needed; improved methods of data acquisition will be developed; and increased emphasis is likely to be given to biological factors. (See also W89-02717) (Lantz-PTT) W89-02723

CHEMICAL WEATHERING OF THE EAST YORKSHIRE CHALK, London Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2K. W89-02731

KARST WATER TEMPERATURE AND THE SHAPING OF MALHAM COVE, YORKSHIRE, For primary bibliographic entry see Field 2F. W89-02737

CHEMICAL EROSION IN TOWER KARST TERRAIN, KINTA VALLEY, PENINSULAR MALAYSIA, Saint David's Univ. Coll., Lampeter (Wales).

Dept. of Geography.

J. Crowther.

IN: New Directions in Karst. Geo Books, Norwich, England. 1986. p 427-441, 2 fig, 2 tab, 42 ref.

Descriptors: *Chemical weathering, *Denudation, *Weathering, *Karst, *Karst hydrology, *Malaysia, Caves, Limestone, Groundwater, Hardness, Carbon dioxide, Carbonates, Soil gases, Chemical properties, Soil water.

Chemical weathering rates in the tower karst ter-rain of the Kinta valley are estimated from two independent data sets: the solutional potential of soil waters, calculated from soil carbon dioxide data; and the total hardness of 148 karst waters, including surface streams, soil throughflow, cave including surface streams, soil throughflow, cave seepages and groundwaters from the alluvium and underlying aquifer of the valley plain. The results reveal marked variations in weathering conditions on the limestone towers, with open system carbon-ate weathering potentials ranging from 82 ppm on rocky hilltops to 210 and 243 ppm, respectively, in hilltop depressions and on the moderate footslopes. This pattern of weathering accentuates the steep-ness and ruggedness of the relief. Total hardness varies between 50 ppm for rivers draining the ness and ruggedness of the relief. Total hardness varies between 50 ppm for rivers draining the alluvial karst plain and 257 ppm (including measured aggressiveness) for groundwaters sampled at the alluvium/bedrock interface in tin mine workings. Chemical denudation is appreciably slower on the tower karst hills (85 mm/1000 yr) than beneath the adjacent plains (155 mm/1000 yr). (See also W89-02728) (Author's abstract)

HYDROLOGICAL DEVELOPMENT OF TROP-ICAL TOWER KARST: AN EXAMPLE FROM PENINSULAR MALAYSIA, For primary bibliographic entry see Field 2F. W89-02739

LIMESTONE WEATHERING UNDER A SOIL COVER AND THE EVOLUTION OF LIME-STONE PAVEMENTS, MALHAM DISTRICT, NORTH YORKSHIRE, UK, Sheffield Univ. (England). Dept. of Geography. S. T. Trudgill.

IN: New Directions in Karst. Geo Books, Norwich, England. 1986. p 461-471, 4 fig, 4 tab, 14 ref.

Descriptors: *Karst hydrology, *Limestone, *Weathering, *Soil erosion, *England, *Geomor-phology, Karst, Bedrock, Carbonates, Acidic soils, Lichens, Subsidence, Acidic water, Yorkshire,

Micro-erosion meter data derived from a subaerial surface site indicate current rates of erosion of the order of 0.01 - 0.05 mm a year. Sub-soil erosion rates, derived from observations of weight loss of limestone fragments, indicate rates both higher and lower than this under acid and alkaline soils respectively. Under acid soils, the soil may subside progressively as bedrock dissolution proceeds, expensing upstanding portions of limestone paverner without the erosional loss of soil. Small scale bedrock landforms of the order of 5-40 cm are thought to have been produced in post glacial times. (See also W89-02728) (Author's abstract) W89-02740

KAMENITZAS OF GAIT BARROWS NATION-AL NATURE RESERVE, NORTH LANCA-SHIRE, ENGLAND, Lancaster Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2F. W89-02741

VALLEY EXCAVATION IN THE YORKSHIRE DALES KARST, Trent Polytechnic, Nottingham (England). For primary bibliographic entry see Field 2F. W89-02742

FORMULAS FOR VELOCITY, SEDIMENT CONCENTRATION AND SUSPENDED SEDIMENT FLUX FOR STEADY UNI-DIRECTION-ALPRESSURE-DRIVEN FLOW, National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.

Lab. H. O. Mofjeld, and J. W. Lavelle. Available from the National Technical Information Service, Springfield, VA. 22161 as PB89-109995. Price codes: A03 in paper copy; A01 in microfiche. NOAA Technical Memorandum ERL PMEL-83, August 1988. 26p, 8 fig. 6 tab, 25 ref.

Descriptors: *Suspended load, *Sediment transport, *Model studies, *Estuaries, *Suspended sediment, *Channel flow, Mathematical studies, Turbulent flow, Water currents, Flow velocity, Erosion rates, Sedimentation.

sion rates, Sedimentation.

A level 2 turbulence closure model for steady pressure-driven currents and suspended sediment concentrations in an unstratified channel leads to analytic formulas for the velocity and the concentration of each settling constituent. The level 2 model uses a parabolic form for the mixing length that increases linearly upward near the bottom and is a maximum at the surface. The model assumes a balance between local turbulence production and dissipation, and the sediment concentrations are assumed to be dilute. The level 2 velocity is found to follow closely the log velocity grofile, being only about 0.5 u² < the log-profile at the surface, where u² is the friction velocity (square root of the kinematic bottom stress). The level 2 concentration matches closely a modified form of the Rouse formula in which the actual depth H is replaced by H' = 1.07 H. The model results provide a theoretical basis for the use of the log velocity and Rouse concentration profiles over the water column based on turbulence closure theory. The vertically integrated flux of suspended sediment (suspended load transport) per unit width computed numerically from the level 2 model is approximated well by the flux derived from the pure log velocity and unmodified (H' = H). Rouse concentration profiles. When normalized by the ratio of erosion rate to the settling velocity was us s, explicit formulas for the log-Rouse flux are functions of the two thes. when normalized by the ratio of erosion rate to the settling velocity wisb, explicit formulas for the log-Rouse flux are functions of the two parameters beta = w sub s/Ku* and z sub o/H (K being the von Karman constant, z sub o the bottom roughness and H the water depth) and is most

Group 2J—Erosion and Sedimentation

sensitive to beta; it is proportional to beta to the -1 power in the slow settling regime beta < 0.1 and decreasing rapidly as beta to the -1 power(beta - 1) to the -2 power in the fast settling regime beta > 2. The flux is a strong function of the bottom stress through the erosion rate which dominates the stress dependence in the slow settling regime. (Author's abstract)

MARTINS FORK LAKE SEDIMENTATION STUDY: HYDRAULIC MODEL INVESTIGA-

TION,
Army Engineer Waterways Experiment Station,
Vicksburg, MS. Hydraulics Lab.
W. D. Martin.
Available from the National Technical Information Service, Springfield, VA. 22161. Technical Report No. HL-88-21, September 1988. Final Report. 47p, 9 fig, 18 tab, 8 ref, append.

Descriptors: *Martins Fork Lake, *Sedimentation, *Hydraulic models, *Reservoirs, *Silting, *Kentucky, Flood control, Dams, Hydrographs, Water

This report presents the analysis of the unexpectedly high rate of infill experienced at Martins Fork Lake, located in Harlan County, KY. The dam which impounds the lake is located in a drainage basin that has been actively strip-mined for a number of years. The study was designed to pre-dict lake storage loss up to 50 years into the future under various assumptions of future conditions. Several remedial measures were also evaluated to Several remedial measures were also evaluated to mitigate loss of storage and recreational benefits. A one-dimensional computer model was developed to analyze the alternatives. The model used was the WES Stream Network Model (HL-1). This is a modified version of the HEC-6 code that allows simultaneous analysis of tributaries and the main stem of a stream network. Results of the alternatives tested revealed that for the assumed future conditions tested, the dam should provide most of condutions rested, the dam should provide most of the intended degree of flood control. The loss of flood-control storage varied from a low of 1.65% to a high of 13.8%. Other alternatives tested the sensitivity of the results by altering the future sensitivity of the results by altering the future conditions. Several different inflowing hydro-graphs were tested in conjunction with several different sets of assumptions as to the amount of sediment that might be transported into the lake. These resulted in losses of flood control storage that varied from 2.94% to 8.98%. Under all alter-natives analyzed, the lake will experience signifi-cant loss of flenth and surface area due to infilling natives analyzed, the lake will experience significant loss of depth and surface area due to infilling. Varying the operating rule curve for the lake reduced the infill rate expected under the current scheme of operation and mitigated the loss of depth in the lake by more evenly distributing the sediment deposition. (Lantz-PTT) W89-02780

DREDGING: TECHNOLOGY AND ENVIRON-MENTAL ASPECTS, CITATIONS FROM THE LIFE SCIENCES COLLECTION DATABASE (JAN 78 - AUG 87).
National Technical Information Service, Spring-

field, VA

18tid, VA. Available from the National Technical Information Service, Springfield, VA. 22161, as PB87-866828. Price codes N01 in paper copy, N01 in microfiche. September 1987. 123p.

Descriptors: "Spoil disposal, "Dredging, "Sediment transport, "Environmental effects, "Bibliog-raphies, Literature review, Ecological effects, Computer models, Ocean dumping, Waste dispos-

This bibliography contains citations concerning the Ints noticigraphy contains citations concerning the technology and environmental impacts of dredging. Equipment, including semi-submersible cutter platforms, is described. Sediment movement, factors affecting sediment movement, and the disposal of dredged material, are considered. The environ-mental impacts of the dredged areas and the effects of ocean dumping of dredged material are also discussed. This updated bibliography contains 295 citations (16 of which are new entries). (Author's

W89-02783

EFFECTS ON SUSPENDED AND SUBSTRATE SEDIMENTS IN TWO STREAMS RESULTING FROM DIFFERENT GAS-PIPELINE INSTAL-RESULTING
RESULTING
READ TECHNIQUES,
Argonne National Lab., IL. Biological, Environmental, and Medical Research Div.
For primary bibliographic entry see Field 4C.
W89-02823

ANALYSIS OF BANK STABILITY IN THE DEC WATERSHEDS, MISSISSIPPI, Queen Elizabeth Coll., London (England). For primary bibliographic entry see Field 4D.

EXPERIMENTAL GEOMORPHOLOGY (DRAINAGE NETWORK, PIEDMONT AND CHANNEL MORPHOLOGY), Colorado State Univ., Fort Collins.

S. A. Schumm.

Available from the National Technical Information Available from the National Technical Information Service, Springfield, VA. 22161, as AD-A188 954. Price codes: A03 in paper copy, A01 in microfiche. Final Report No. ARO 21345.3-6S, October 15, 1987. 20p, 6 fig, 7 ref.

Descriptors: *Geomorphology, *Channel morphology, *Piedmonts, *Geohydrology, *Rainfall-runoff relationships, *Drainage patterns, Erosion, Channels, Uplift, Model studies.

A series of experimental studies were carried out in a large rainfall-erosion facility and in a large flume. Braided-stream experiments reveal that significant differences in the shape of bars, braiding index and channel behavior depend on channel gradient and channel behavior depend on channel gradient and sediment load. Deformation of a drainage network by uplift produced fractures that followed the drainage pattern. Incision of the pattern depends on rate of uplift, with slow uplift permitting lateral shift but rapid uplift producing vertical incision. The junction angles of drainage patterns change markedly at a surface slope of about 2%, and the effect of vegetation cover on erosion rates is minimal below 7% cover. Multiple pediments formed, during experiments on the development of piedmont landforms, when piedmont drainages integrated and incised. (Author's abstract) W89-02847 a large rainfall-erosion facility and in a large flume.

I-664 BRIDGE-TUNNEL STUDY, VIRGINIA SEDIMENTATION AND CIRCULATION IN-

VESTIGATION,
Army Engineer Waterways Experiment Station,
Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 4C.
W89-02875

CATCHMENT EXPERIMENTS IN FLUVIAL GEOMORPHOLOGY.
For primary bibliographic entry see Field 2E. W89-02880

CATCHMENT EXPERIMENTS IN FLUVIAL GEOMORPHOLOGY: A REVIEW OF OBJECTIVES AND METHODOLOGY,

Exeter Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2E. W89-02881

CONTROLS ON OVERLAND FLOW GENERA-

TION,
Bristol Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W89-02882

SPATIAL VARIABILITY OF SOIL HYDRODY-NAMIC PROPERTIES IN THE PETITE FECHT CATCHMENT, SOULTZEREN, FRANCE - PRE-

LIMINARY RESULTS, Strasbourg-1 Univ. (France). Inst. de Geographie. For primary bibliographic entry see Field 2G. W89-02883

PIPEFLOW AND PIPE EROSION IN THE MAESNANT EXPERIMENTAL CATCHMENT, University Coll. of Wales, Aberystwyth. Dept. of

Geography.
For primary bibliographic entry see Field 2E.
W89-02884

PATTERN OF WASH EROSION AROUND AN UPLAND STREAM HEAD,
Geomorphological Services Ltd., Marlow (Eng-

M. McCaig.

1N: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 87-114, 10 fig, 5 tab, 11 ref.

Descriptors: *Stream erosion, *Gullying, *Fluvial geomorphology, *Overland flow, Catchment areas, *Geomorphology, *Runoff, Erosion, Streams, Mapping, Catchment areas, Pipe flow,

The sampling design and methods used to determine the pattern of wash erosion around a simple landform, an upland stream head in the Central Pennines of Yorkshire, are described. Results have Pennines of Yorkshire, are described. Results have shown that surface wash volumes and sediment transport rate are closely related to the area drained per unit contour length at the sampling point. Mapping area drained (a) and slope gradient (s) together as the surrogate mapping variable ln(a/s) showed a complex pattern in the study catchment due to the occurrence of natural pipe systems. Relationships between ln(a/s), wash frequency, wash volume and sediment transport have been examined and maps produced. The results show that frequently wet drainage line areas (high ln(a/s)) which occupy only 2-7% of the catchment area account for around 80% of the erosion accomplished by surface wash beyond the headward extent of the perennial stream channel. The ln(a/s) variable has also been incorporated into a hydrologically based simulation model of erosion in and around the stream head. The model has been used to investigate the influence of different catchment arount the stream nead. The model has been used to investigate the influence of different catchment hydrological characteristics on the pattern of ero-sion. (See also W89-02880) (Author's abstract) W89-02886

RUNOFF AND SEDIMENT TRANSPORT DYNAMICS IN CANADIAN BADLAND MICROCATCHMENTS,

Scarborough Coll., Westhill (Ontario). Dept. of Geography For primary bibliographic entry see Field 2E.

W89-02887

RUNOFF AND SEDIMENT PRODUCTION IN A SMALL PEAT-COVERED CATCHMENT: SOME PRELIMINARY RESULTS, Huddersfield Polytechnic (England). Dept. of Ge-

ography. For primary bibliographic entry see Field 2E. W89-02888

RAPID SUBSURFACE FLOW AND STREAM-FLOW SOLUTE LOSSES IN A MIXED EVER-GREEN FOREST, NEW ZEALAND,

Ministry of Works and Development, Christ-church (New Zealand). For primary bibliographic entry see Field 2G. W89-02890

HYDROLOGY AND SOLUTE UPTAKE IN HILLSLOPE SOILS ON MAGNESIAN LIME-STONE: THE WHITWELL WOOD PROJECT, Sheffield Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2G. W89-02891

SURFACE AND SUBSURFACE SOURCES OF SUSPENDED SOLIDS IN FORESTED DRAIN-AGE BASINS IN THE KEUPER REGION OF

Amsterdam Univ. (Netherlands). Lab. for Physical Geography and Soil Science.

Erosion and Sedimentation—Group 2J

A. C. Imeson, M. Vis, and J. J. H. M. Duysings. IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 219-233, 7 fig. 2 tab, 13 ref.

Descriptors: *Erosion, *Forest hydrology, *Geomorphology, *Luxembourg, *S --nended solids, Streams, Rivers, Fluvial geomorphology, Catchment areas, Forest watersheds, Weathering, Sediment yield, Sedimentation, Flow.

The results of a number of field experiments designed to locate and evaluate non-channel sediment sources are described. The forested drainage basins sources are user roles. In corested uranage ossur-of the Keuper region of Luxembourg are charac-terized by relatively high rates of erosion and sediment transport. Excluding the river channels, it is possible to distinguish between surface and subis possible to distinguish of event surface and sub-surface sources of suspended solids. Both sources are widely distributed throughout the catchment studied. The subsurface sources are probably locat-ed in the upper part of the B horizon where clay is dispersed and transported by through-flow to topographic depressions which drain to the catch ment rivers. Surface sources of suspended solids are formed where areas of soil are exposed by zoogenic processes. On certain occasions, sediment from these two sources arrive at different times in the rivers to produce a double peaked turbidity trace. The amount of interflow supplying sediment from the subsurface sources can be calculated. The relationship between sediment supply and turbidity is discussed for the Schrondweilerbaach for a number of flood events. A comparison is made between the forested Keiwelsbaach and cultivated Mosergriecht drainage basins. For the flood con-sidered more than 36% of the suspended solids are supplied from subsurface sources to the Keiwelsbaach as opposed to 8% to the Mosergriecht. (See also W89-02880) (Author's abstract)

SOURCES OF VARIATION OF SOIL ERODIBILITY IN WOODED DRAINAGE BASINS IN LUXEMBOURG, Amsterdam Univ. (Netherlands). Lab. for Physical

Amsterdam Univ. (Nethertands). Lab. for Physical Geography and Soil Science. P. D. Jungerius, and H. J. M. VanZon. IN: Catchment Experiments in Fluvial Geomor-phology. Geo Books, Norwich, England. 1984. p 235-246, 5 tab, 11 ref, append.

Descriptors: *Forest watersheds, *Forest hydrology, *Sediment yield, *Geomorphology, *Erosion, *Soil erosion, *Luxembourg, Moles, Worms, Fluvial geomorphology, Catchment areas, Geomorphology, Sedimentation, Ecosystem.

Studies of the forest ecosystems in Luxembourg carried out by the University of Amsterdam during the last decade are described. The long-term aim of these studies is to assess the factors important for sediment production and to ascertain the relations sediment production and to ascertain the relations between these factors and explain variations in sediment production between and within catchenents, in order to be able to predict sediment yield. In this short-term experimental studies, parts of this general problem have been tackled in a sort of trial and error method. A large part of the sediment reaching streams from wooded slopes in Luxembourg is derived from bare parts of the forest floor which are exposed to splash. Sediment yield is therefore partly a function of the size and torest noor which are exposed to spiash. Sediment yield is therefore partly a function of the size and the erodibility of the exposed areas. Both characteristics are related to soil fauna activities. The erodibility of these areas was investigated in five drainage basins. Variation in erodibility could, to extent, be explained if the drainage basins divided into landscape units which represent different ecosystems. Although soil fauna is largely dependent on the ecological conditions of the landscape units they form an important second source of variation in soil erodibility, at times over-ruling the importance of the first source. This is mainly because soil animals bring material to the surface from soil horizons with different resistance to erofrom soil horizons with different resistance to ero-sion. The effect of the animals is to reduce the differences between landscape units. This is partly because moles increase the erodibility of the sur-face material whereas worms decrease it. (See also W89-02880) (Miller-PTT) w89-02881

MICROEROSION PROCESSES AND SEDI-MENT MOBILIZATION IN A ROADBANK GULLY CATCHMENT IN CENTRAL OKLA-

HOMA, Oxford Polytechnic (England). Dept. of Geogra-

phy.
M. J. Haigh.
IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 247-264, 8 fig., 2 tab, 23 ref.

Descriptors: *Roadbanks, *Erosion, *Sediment yield, *Oklahoma, *Freeze-thaw cycle, *Frost action, Sedimentation, Sediment transport, Gully erosion, Precipitation, Fluvial geomorphology, Rill erosion.

A case study of the erosion of a typical small, road-bank gully catchment is described. Erosion has been monitored for 5 years and a soil loss of 520 t/ ha/year has been documented. Microrill activity contributes significantly to the surface roughness of the debris slope. Wash deposits at the slope foot retain a relatively high proportion of mobilized sediments in the 0.2 to 0.6 mm size range. Annual ground loss totals are closely related to annual precipitation and the number of freeze-thaw cycles. (See also W89-02880) (Author's abstract) W89-02894

WATER AND SEDIMENT DYNAMICS OF THE

WATER AND SEDIMENT DYNAMICS OF THE HOMERKA CATCHMENT,
Polish Academy of Sciences, Krakow. Inst. of Geography and Spatial Organization.
W. Froehlich, and J. Slupik.
IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 265-276, 9 fig, 1 tab, 17 ref.

Descriptors: *Poland, *Soil erosion, *Rainfall-runoff relationships, *Sediment yield, *Catchment areas, *Geomorphology, Sedimentation, Channels, Denudation, Sediment discharge, Fluvial geomorphology, Photogrammetry.

Studies of the slope and channel subsystems under-taken within the 18 sq km Homerka catchment in the Flysch Carpathians of Poland are described. the Flysch Carpathians of Poland are described. Water and solute discharges and sediment loads demonstrate a positive linear relationship with catchment area. Specific discharge and denudation rates exhibit an inverse relationship with basin area. These relationships must be taken into account when analyzing the relationship between the response of a sub-catchment and that of the whole drainage basin. In all of the basins studied, soil erosion rates are very high and relate to a young region with marked endogenic and exogenic mobility of the relief. In all the catchments, a great variability of geomorphological processes in time and space was found. Lithological contrasts are responsible for major variations on the mechanisms of channel and slope material movement. Temporal variation in annual precipitation cause very ral variation in annual precipitation cause very significant differences in the annual rate of soil erosion. These investigations emphasize the value of photogrammetric techniques for geomorphological experiments in young regions with a marked mobility of relief. (See also W89-02880) (Miller-PTT) W89-02895

SOURCES OF SEDIMENT AND CHANNEL CHANGES IN SMALL CATCHMENTS OF RO-MANIA'S HILLY REGIONS, Institutul de Geografie, Bucharest (Romania). D. Balteanu, G. Mihaiu, N. Negut, and L.

Capiescu. In: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 277-288, 4 fig, 5 tab, 5 ref.

Descriptors: *Soil erosion, *Gully erosion, *Geomorphology, *Erosion, *Romania, Channels, *Photogrammetry, Topography, Runoff, Small watersheds, Channel erosion, Sedimentation.

The hilly regions of Romania cover one-third of the country and supply 41% of the average annual runoff. Erosion rates are high and values of sus-pended sediment yield in excess of 25 Vha/year

have been recorded. Three small catchments in the southeast Carpathians have been studied and present-day processes have been documented using repeated aerial and terrestrial photographs over a period of 10-17 years. The photogrammetric evi-dence has been correlated with topographic surdence has been correlated with topograpme sur-veys, reservoir accumulation data and periodic measurements of reference markers. Information on rates of gully growth, volumes of material eroded and rates of reservoir sedimentation has been assembled. (See also W89-02880) (Author's

LANDSLIDING, SLOPE DEVELOPMENT AND SEDIMENT YIELD IN A TEMPERATE ENVI-RONMENT: NORTHEAST ROMANIA,

ROMANIA, Statiunea de Cercetari Stejarul, Piatra-Neamt (Ro-mania). Geomorphology Lab. I. Ichim, V. Surdeanu, and N. Radoane.

In: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 289-297, 7 fig, 1 tab, 5 ref.

Descriptors: *Erosion, *Landslides, *Mass wasting, *Gully erosion, *Geomorphology, Sedimentation, *Sediment yield, *Romania, Forests, Slopes, Temperate zone, Fluvial geomorphology, Slope degradation, Channel erosion.

Sediment yield in Romania is greatest in spring as gullies and channels are cleared of material during prolonged runoff from frontal rains. The period from May to early July is more critical for slope from May to early July is more critical for slope wash erosion but this is more localized. In the mountain forests, gullies and river beds are important sediment sources and slopes develop basal convexities. In the hill regions, slope erosion exceeds stream removal and concave footslopes develop. Many areas are influenced by landslides, especially after deforestation, and very high sediment yields are produced. (See also W89-02880) (Author's abstract) W89-02897 W89-02897

DEVELOPMENT OF FIELD TECHNIQUES FOR ASSESSMENT OF RIVER EROSION AND DEPOSITION IN MID-WALES, UK,

Institute of Hydrology, Powys (Wales).

IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 299-309, 4 fig, 2 tab, 5 ref.

Descriptors: *Tracers, *Sediment transport, *Geomorphology, *Sedimentation, *Erosion, *Wales, Water sampling, Suspended load, Shoals, Rivers, Fluvial geomorphology, Field tests, Particle size,

Techniques and instrumentation employed by the Institute of Hydrology in a five year programme of research to generate and analyze a database of river erosion and deposition in Mid-Wales are described. These include topographic surveys using Infra-red Electronic Distance Measurement equipment and theodolites, sediment sampling on shoals, the measurement of suspended sediment and bed load transport, and sediment tracing using artificially enhanced magnetic susceptibility. It was possible to trace magnetized sediment up to 500 m downstream of the injection site and the sediment tracing method is proving particularly successful in tracing the movement of different sized particles across shoal features in the downstream zone. (See also W89-02880) (Miller-PTT) Techniques and instrumentation employed by the W89-02898

SUSPENDED SEDIMENT PROPERTIES AND THEIR GEOMORPHOLOGICAL SIGNIFI-

CANCE, Liviv. (England). Dept. of Geography. D. E. Walling, and P. Kane. IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 311-334, 5 fig, 11 tab, 35 ref.

Descriptors: *Suspended load, *Path of pollutants, *Geomorphology, *Sedimentation, *Suspended

Group 2J-Erosion and Sedimentation

sediments, Nonpoint pollution sources, Sediment transport, Fluvial geomorphology, England, Parti-

Concern for non-point pollution and contaminant transport within the fluvial system has directed attention to the significance of suspended sediment properties in influencing sediment-associated transport. It is suggested that the geomorphologist can profitably broaden his own perspective to include the properties of the sediment as well as the magnitude of the transported loads. The potential significance of studies of sediment properties in catchment studies are illustrated by examples taken from an ongoing study of suspended sediment and solute transport within the 1500 sq km Exe basin, Devon, UK. Attention is given to particle-size characteris-UK. Attention is given to particle-size characteris-tics of suspended sediment, the relationship of nature of the material leaving the basin to that of nature of the material leaving the basin to that of the source material, the fingerprinting of sediment sources and the elucidation of processes operating within the basin sediment systems. (See also W89-02880) (Author's abstract) W89-02899

SOME IMPLICATIONS OF SMALL CATCH-MENT SOLUTE STUDIES FOR GEOMOR-PHOLOGICAL RESEARCH,

Coventry (Lanchester) Polytechnic (England). Dept. of Geography. For primary bibliographic entry see Field 2E. W89-02902

HYDROCHEMICAL CHARACTERISTICS OF A DARTMOOR HILLSLOPE, Plymouth Polytechnic (England). Dept. of Geo-graphical Sciences. For primary bibliographic entry see Field 2E. W89-02903

MAGNITUDE AND FREQUENCY CHARACTERISTICS OF SUSPENDED SEDIMENT TRANSPORT IN DEVON RIVERS,

Exeter Univ. (England). Dept. of Geography.
B. W. Webb, and D. E. Walling.
IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p
399-415, 7 fig. 3 tab, 28 ref.

*Sediment discharge, *Eng *Geomorphology, Sedimentation, *Suspended sediment, *Sediment transport, *Rivers, River systems, Sediment yield, Fluvial geomorphology.

Continuous monitoring of suspended sediment con-centrations in tributaries of the Exe Basin, Devon, UK, including nine years for the River Creedy and five years for the Rivers Dart and Barle, has provided an opportunity to establish medium-term magnitude and frequency properties of suspended solids removal and to evaluate contrasts in sediment transport within a river system. Results reveal significant contrasts between tributaries in specific sediment yields, annual regime of sediment loads, the timing of suspended solids removal and the role of extreme events in sediment transport, which reflect variations in catchment scale and sediment availability. (See also W89-02880) (Author's abstract) W89-02904

RELATIONSHIP BETWEEN SOIL CREEP RATE AND CERTAIN CONTROLLING VARIA-BLES IN A CATCHMENT IN UPPER WEAR-DALE, NORTHERN ENGLAND, Durham Univ. (England). Dept. of Geography. E.W. Anderson, and N. J. Cox. IN: Catchment Experiments in Fluvial Geomor-phology. Geo Books, Norwich, England. 1984. p 419-430, 2 fig. 2 tab, 18 ref.

Descriptors: *Mass wasting, *Geomorphology, *Soil creep, *England, Model studies, Hydrologic models, *Soil water, Fluvial geomorphology, Catchment areas.

Soil creep rate has been monitored at 20 plots in a small catchment near Rookhope in upper Wear-dale, northern England, and measurements made of

several associated controlling variables. The observational design is aimed to produce measurements form a variety of different slope, soil, moisture and vegetation conditions, and to allow comparison of different instruments. Models predicting soil creep rate as a function of controlling variables have been obtained using statistical analysis. The strong interdependence of controlling variables implies that models with only one predictor are the most satisfactory. Moisture and related variables are the important controls of creep in the catchment. The relationship between creep and slope gradient is weak and negative. (See also W89-02880) (Author's abstract) several associated controlling variables. The obser-

PATTERNS OF HILLSLOPE SOLUTIONAL DENUDATION IN RELATION TO THE SPATIAL DISTRIBUTION OF SOIL MOISTURE AND SOIL CHEMISTRY OVER A HILLSLOPE HOLLOW AND SPUR, Huddersfield Polytechnic (England). Dept. of General Control of Gen

T. P. Burt, R. W. Crabtree, and N. A. Fielder.
IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p
431-445, 7 fig. 17 ref.

Descriptors: *Slopes, *Soil solution, *Soil chemistry, *Weathering, *Water chemistry, *Geomorphology, *Soil water, *Denudation, Acidic water, Fluvial geomorphology.

The pattern of soil moisture distribution in a hillslope hollow and its adjacent spurs is discussed in relation to observations of the distribution of iron relation to observations of the distribution of iron in soil profiles up the hollow, and to the pattern of micro-weight loss experienced by rock tablets placed in the soil at various locations over the hillslope. The results suggest that the hollow is the main focus of solutional denudation. Soils there remain wet for the greatest length of time and acidic water is rapidly transmitted down the hollow due to continued presence of the saturated wedge. (See also W89-02880) (Author's abstract) W89-02906

SOME RELATIONSHIPS BETWEEN DEBRIS FLOW MOTION AND MICRO-TOPOGRAPHY FOR THE KAMIKAMIHORI FAN, NORTH JAPAN ALPS, Kyoto Univ. (Japan). Disaster Prevention Re-search Just

search Inst. S. Okuda, and H. Suwa.

In: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 447-464, 8 fig, 2 tab, 8 ref.

Descriptors: *Geomorphology, Debris, Model studies, Hydrologic models, *Alluvial fans, *Japan, *Alpine regions, *Debris flows, *Mass wasting, *Sediment transport, Flow, Topography, Fluvial geomorphology, Catchment areas, Debris cones.

The dynamic characteristics of debris flows were observed at Kamikamihori Fan with an automatic recording system and micro-topographical changes in the fan were investigated by repeated surveys. Observations on changes in front velocity and the Observations on changes in front velocity and the longitudinal flow path were analyzed using a simple, one-dimensional model of mass point motion. Travel distance was correlated with hydrological and physical factors controlling the flow properties. Topographical changes on the fan resulting from scouring and deposition were evaluated and characteristic depositional forms are described. A correlation matrix of the physical factors which seemed to influence the travel distance showed that the frontal velocity at the entrance to tors which seemed to influence the travel distance showed that the frontal velocity at the entrance to the fan was the most important control of the travel distance. The apparent friction coefficient was calculated. From the profiles of the debris flow course on the fan, and was estimated taking the front velocity V into consideration. The estimated values of the friction coefficient obtained from both mehtods from 0.0095-0.11. Surveys of the depositional form of the debris flow demonstrated the existence of two different of debris flow deposition on the fan. Thick swollen lobes containing large boulders are deposited in the upper region, while thin flat loes contained pebbles and

cobbles are primarily deposited in the lower region. (See also W89-02880) (Miller-PTT) W89-02907

PRECISE MEASUREMENT OF MICROFORMS AND FABRIC OF ALLUVIAL CONES FOR PREDICTION OF LANDFORM EVOLUTION, Osaka City Univ. (Japan). Dept. of Physics. M. Hirano, and T. Ishii.

In: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 465-475, 7 fig, 5 ref.

Descriptors: *Data acquisition, *Mass wasting, *Sediment transport, *Geomorphology, *Alluvial fans, *Debris, *Flow, Maps, Japan, Fluvial geomorphology, Catchment areas, Debris cones, Photogrammetry, Prediction.

The slope profiler devised by Ishii was used to measure the detailed form of alluvial cones or fans chiefly by debris flow under a humid climate. The fabric of surface materials on alluvial cones was also recorded, partly by conventional photogrametry using wire nets, and partly by sketching at the time of profile measurement, in order to analyze the process of cone formation. In addition. the time of pronie measurement, in order to analyze the process of cone formation. In addition, subsurface profiles along longitudinal sections of the cone were obtained in an open trench whenever possible. Detailed maps obtained at cones in the Ashio Mountain, Kanto, Japan are shown. The formation of these cones is discussed in relation to the meteorological records and to the subsurface profile. In the case of a fan at the foot of Mt. Yakedake, an active volcano near Kamokochi, Yakcoake, an active voicano near Kamokochi, Central Japan, mapping of microforms focussed on the portion near the outlet of a gully which sup-plies debris flows frequently. If the volume and/or rate of future debris flows are tentatively assumed, prediction of orientation and travel distance is to some degree possible. Measurement of topography can be useful for analysing the caracteristic processes which created the present landform. The measurements undertaken at Ashio demonstrated measurements undertaken at Asino demonstrated that a number of lobes (flow units) can be distinguished and that a group of individual lobes may be correlated with meteorological events. The same measurements of topography and fabric undertaken at Mt. Yakedake demonstrated that chardetaken at Mt. Yakedake demonstrated that characteristic erosional topography produced by debris flows exhibits a definite pattern of meandering which has been controlled by the distribution of larger stones. In addition, it is possible to distinguish individual lobes produced on different occasions on the basis of their state of dissection. The surface fabric of the cones and fans provides important information for understanding the processes that shaped the present landform, in addition to the information for composing contour lines. From both these points of view, precise measurement of three-dimensional topography and fabric using appropriate and rigorous techniques, such as those described here, are shown to provide a sound basis for field experiments in geomorphology. (See also W89-02880) (Author's abstract)

ANALYSIS OF SEDIMENT TRANSPORT BY DEBRIS FLOWS IN THE JIANGJIA GULLY, YUNNAN.

YUNNAN, Chengdu Inst. of Geography (China). K. Zhicheng, and Z. Shucheng. IN: Catchment Experiments in Fluvial Geomor-phology. Geo Books, Norwich, England. 1984. p 477-488, 11 fig, 3 tab, 2 ref.

Descriptors: *Gully erosion, *China, *Debris flows, *Mass wasting, *Catchment areas, *Catchment basins, *Sediment transport, Fluvial geomorphology, Geomorphology.

Many years of observation of the Jiangjia Gully, a large-scale debris flow gully in northeast Yunnan, are described. It has a drainage area of 47.1 sq km and the trunk gully is 12 km long. Debris flows occur frequently and a study of their behavior has been undertaken. Because debris flow control schemes are costly to implement and the practical effects of the schemes were uncertain, a pilot project was conducted between 1973 - 1974. A

Erosion and Sedimentation—Group 2J

debris basin with an area of 0.36 sq km built on the deposition fan in the lower reaches of the Jiangjis Gully retained 2.25 million m of solid material from the debris flows between 1973 and 1975. A 5 from the debris flows between 1973 and 1975. A 5 m high silt arrester constructed across the trunk gully retained 2.5 million m of solid material so that the length of the stable longitudinal slope now reaches 5 km and the original longitudinal slope was reduced by 20%. The afforestation and check dam project carried out in parts of the upper reaches has also achieved some success. Debris flow control schemes must be based on a sound knowledge of the factors governing debris flow formation. (See also W89-02880) (Miller-PTT) W89-02909

FLOW PROCESSES AND RIVER CHANNEL

FLOW PROCESSES AND RIVER CHANNEL MORPHOLOGY, University of East Anglia, Norwich (England). School of Environmental Sciences. R. D. Hey, and C. R. Thorne. In: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 489-514, 9 fig, 2 tab, 56 ref.

Descriptors: *Streamflow, *Channel morphology, *Sediment transport, *Channel erosion, *Geomor-phology, Channeling, Flow, Model studies, Flow resistance, Erosion, Meanders, Fluvial geomorphology, Rivers

logy, Rivers.

The use of process-response models in the study of channel form is discussed. Study of flow processes in gravel-bed rivers must include consideration of secondary flows, boundary shear stresses, flow resistance, bed load transport, bank erosion, bar deposition, and meander mechanisms. The application of conceptual, mathematical and empirical models to the dynamic modelling of channel morphology is reviewed. A simple qualitative model, based on the operation of sediment transport processes and upstream and downstream feedback mechanisms, has been developed from consideration of spatial and temporal changes in bankfull values of channel slope, flow depth, bed material size, bed shear stress and sediment transport rates during periods of erosion and deposition. The model predicts a damped oscillation between erosional and depositional activity in time and space as the river responds to an initial instability resulting from changes in either climate, sediment yield, runoff, land or sea levels. Potentially, mathematical modeling techniques offer the best solution to the problem of predicting channel responses to changes in discharge and sediment load. When developing empirical models of channel development, it is necessary to use both field process measurements and documentary historical analyses to develop a empirical models of channel development, it is necessary to use both field process measurements and documentary historical analyses to develop a good understanding of the way in which channel form relates to channel processes. (See also W89-02880) (Miller-PTT)

INFLUENCE OF VEGETATION ON STREAM CHANNEL PROCESSES,
Southampton Univ. (England). Dept. of Geogra-

phy.
A. M. Gurnell, and K. J. Gregory.
IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 515-535, 10 fig, 3 tab, 36 ref.

Descriptors: *Channel morphology, *Vegetation effects, *Stream erosion, *Geomorphology, Channels, Vegetation, Streams, Soil water, Catchment areas, Drainage, Fluvial geomorphology.

Vegetation exercises an influence upon stream channel processes in at least three main ways and these are analyzed by reference to empirical data obtained from the Highland Water Catchment in the New Forest, Hampshire. The significance of vegetation has been investigated at three scales: (1) in relation to drainage network dynamics and discharge within a subcatchment, (2) in relation to soil moisture variations and soil permeability on a single hillslope, and (3) in relation to the components of the main drainage network, with particular emphasis on channel form and change within the Highland Water itself. It is clear that just as vegetation can be an indicator of runoff production

at the subcatchment and hillslope scale, it can provide an influence upon the flow and sediment routing and storage at the catchment scale and an influence upon channel morphology, particularly where stream channel adjustment is taking place. (See also W89-02880) (Miller-PTT) W89-02911

STREAM RESPONSE TO FLASH FLOODS IN UPLAND SCOTLAND, Saint Andrews Univ. (Scotland). Dept. of Geogra-

phy.
For primary bibliographic entry see Field 2E.
W89-02912

EXPERIMENTAL METHOD IN GEOMOR-PHOLOGY,

nbia Univ., Vancouver. Dept. of Geography.
For primary bibliographic entry see Field 2E.
W89-02913

AGGRADATION AND DEGRADATION OF AL-LUVIAL SAND DEPOSITS, 1965 TO 1986, COL-ORADO RIVER, GRAND CANYON NATIONAL PARK, ARIZONA,

Geological Survey, Tucson, AZ. Water Resources

Div. J. C. Schmidt, and J. B. Graf. J. C. Schmidt, and J. B. Grat. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-195458. Price codes: A06 in paper copy, A01 in microfiche. Open-File Report 87-555, April 1988. 120p. 34 fig, 14 tab, 28 ref. Bureau of Reclamation Contract IA-3-AA-40-01260

Descriptors: *Channel morphology, *Alluvial channels, *Arizona, *Sedimentation, *Sediment transport, *Colorado River, Sand, Scour, Alluvial deposits, Erosion, Flow velocity, Geomorphology.

deposits, Erosion, Flow velocity, Geomorphology. High discharges occurring between 1983-1985 resulted in redistribution of sand stored in zones of recirculating current in the Colorado River in Grand Canyon National Park. Redistribution resulted in net loss in the number of reattachment deposits in narrow reaches and aggradation of some separation deposits. Separation deposits were more stable than other types of deposits. Alluvial sand deposits that are large enough and of sufficient size for use as campsites were more stable than smaller lower-elevation deposits. Fluctuating flows between October 1985 and January 1986 caused erosion throughout the Grand Canyon, and caused erosion of some deposits created by the high flows of 1983-1985. Data collected for this study included measurements of flow velocity, scour-and-fill of sand deposits, topographic and bathymetric surveys, mapping of surface-flow patterns, water-surface slope surveys, sedimentological analysis, and replication of photographs. A classification system of alluvial sand deposits was developed on the basis of morphometric characteristics and the location of these deposits in relation to parts of recirculation zones. (Author's abstract) W89-02973

DENDROGEOMORPHIC EVIDENCE AND DATING OF RECENT DEBRIS FLOWS ON MOUNT SHASTA, NORTHERN CALIFORNIA, C. R. Hupp, W. R. Osterkamp, and J. L. Thornton. Available from Books and Open-File Reports Section, USGS, Box 25425, Denver, CO 80225. USGS Professional Paper 1396-B, 1987. 39p, 23 fig, 2 tab, 59 ref, (Debris-Flow Activity and Associated Hazards on Mount Shasta, Northern California).

Descriptors: *Debris flows, *Mass wasting, *Detri-tus, *Dendrochronology, *Mountains, *California, Mount Shasta, Glacial streams, Volcanoes, Geo-morphology, Drainage basins, Scour, Snowmelt, Alluvial fans, Dating.

Evidence of debris flows is common along the glacially fed streams of the Mount Shasta volcano, California. These streams are Whitney Creek, Bolam Creek, Mud Creek, Ash Creek, Gravel Creek, and Inconstance Creek. Debris flow since 1580 can be documented by studying trees dam-

aged by or growing on debris flows. Dates obtained from tree-ring analysis proved consistent with documented records of debris flows. Debris-flow dates in conjunction with geomorphic evidence permit the development of magnitude and frequency relations over a period of about 400 years. Dendrogeomorphic evidence shows that debris flows are a common occurrence on many Mount Shasta streams. Debris flows traveling at least 2 kilometers have occurred at a frequency of about 10.5 debris flows per century; certain basins are more active than others, the Gravel Creek and Mud Creek basins area among the most active, and Inconstance Creek basin is the least active. Small debris flow are more frequent and usually do not move as far downslope as large debris flows in and adjacent to stream channels and on debris fans is suggested by dendrogemorphic evidence and seems to be related to event magnitude and frequency. Distinct periods of heightened debris-flow activity and quiescent periods occur in individual basins and are apparently related to glacial and valley wall stability and meltwater supply. Debris flows of all magnitudes appear to be the major sufficial geomorphic agent during noneruptive times that sculpture the channels and develop large alluvial fans. (See also W89-03029) (Author's abstract) stract) W89-03028

MAGNITUDE AND FREQUENCY OF DEBRIS FLOWS, AND AREAS OF HAZARD ON MOUNT SHASTA, NORTHERN CALIFORNIA,

Geological Survey, Lakewood, CO. W. R. Osterkamp, C. R. Hupp, and J. C. Blodgett. w. R. Osterkamp, C. R. Hupp, and J. C. Biodgett. Available from Books and Open-File Reports Section, USGS, Box 25425, Denver, CO 80225. USGS Professional Paper 1396-C, 1986. 21p, 7 fig. 2 tab, 20 ref, 1 plate in pocket, (Debris-Flow Activity and Associated Hazards on Mount Shasta, Northern California).

Descriptors: *Debris flows, *Mass wasting, *Detri-tus, *Mountains, *Hazards, *California, Mount Shasta, Runoff, Glacial streams, Slope stability, Landslides, Slurries, Snowmelt, Sediment yield, Alluvial fans, Aggradation, Denudation.

Laudsinges, Sturries, Snowmelt, Sediment yield, Alluvial fans, Aggradation, Denudation.

Debris flows on Mount Shasta, northern California, have occurred frequently during the late Holocene in response to rapid runoff from melting snow and ice. Glacial-meltwater streams that deeply incise unstable pyroclastic and related flow deposits typically form debris flows when high discharges cause slope failures within steep-walled gorges. The landslide material either absorbs streamflow quickly and becomes a slurry or briefly dams the stream and converts to a debris flow activity during the last 500 years. During this period, large-magnitude, potentially destructive flows on Mount Shasta have had repeated debris-flow activity during the last 500 years. During this period, large-magnitude, potentially destructive flows on Mount Shasta have occurred at a rate of four per century, but smaller flows contained by stream channels may be 10 to 20 times more numerous. The smaller debris flows of Mount Shasta pose little hazard to human life or property, whereas larger, out-of-channel flows could cause minor damage. Only the City of McCloud and inhabited areas on the Whitney-Bolam fan appear to be threatened by possible debris-flow activity. None of the streams lacking glacial meltwater have had significant debris-flow activity during late Holocene time. Sediment yields from upper slopes is redeposited on lower fan areas, locally causing extensive and rapid aggradation of the fan surface. Little sediment enters a through-flowing stream network. Correspondingly high denudation rates in the areas that provide sediment for debris flows may be unique to recent centuries. (See also W89-03028) (Author's abstract) W89-03029

RUNOFF CHARACTERISTICS AND WASHOFF LOADS FROM RAINFALL-SIMULATION EXPERIMENTS ON A STREET SUR

Group 2J-Erosion and Sedimentation

FACE AND A NATIVE PASTURE IN THE DENVER METROPOLITAN AREA, COLORA-

DO, Geological Survey, Arvada, CO. For primary bibliographic entry see Field 2E. W89-03036

MONITORING BASELINE SUSPENDED SEDI-MENT IN FORESTED BASINS; THE EFFECTS OF SAMPLING ON SUSPENDED SEDIMENT

RATING CURVES,
Pacific Southwest Forest and Range Experiment
Station, Arcata, CA.

Pacinic Gotaline Gotaline Station, Arcata, CA.
R. B. Thomas.
Hydrological Sciences Journal HSJODN, Vol. 33,
No. 5, p 499-514, October 1988. 8 fig, 3 tab, 13 ref.

Descriptors: *Suspended sediments, *Sampling, *Data interpretation, *Baseline studies, *Forest watersheds, Fluvial sediments, Sediment discharge, Sediment yield, Data acquisition, Graphical analysis, Statistical methods, California, Land manage-

Rating curves are widely used for directly assessing changes in the suspended-sediment delivery process and indirectly for estimating total yields. Four sampling methods were simulated over a 31-day record of suspended sediment from the North Fork of the Mad River near Korbel, California. The sampling methods used were: (1) simple random time-based, (2) fixed-interval (or systematrandom time-based, (2) Interd-interval (or systematics) time-based, (3) flow-proportional discharge-based, and (4) Selection At List Time (SALT) discharge-based sampling. The position and size of the four groups of plotted slope/intercept pairs indicated differences in bias and variance among the methods. Estimates of total yield for the 31-day period and for storms of three sizes were also biased according to sampling method. Standard bias correction for lognormal transformations imonas correction for lognormal transformations im-proved yield estimates, but did not remove sam-pling bias uniformly. Methods of data collection have a large and systematic effect on the estimates of suspended sediment yield. Differences attributed to land management may, in fact, result from changes in sampling methods. (Author's abstract) W89-03053

ROLE OF ICE IN THE MORPHO-SEDIMENTOLOGIC REGIME OF A SHORELINE IN
THE MIDDLE SAINT LAWRENCE ESTUARY
(LE ROLE DES GLACES DANS LE REGIME
MORPHO-SEDIMENTOLOGIQUE D'UN
ESTRAN DE L'ESTUAIRE MOYEN DU SAINTALIBENTA

ESTRAIN DE L'ESTUAIRE MOTES DE GARA-LAURENT), Laval Univ., Quebec. Dept. of Civil Engineering. J. P. Troude, and J. B. Seroudes. Canadian Journal of Civil Engineering CJCEB8, Vol. 15, No. 3, p 348-354, June 1988. 2 fig. 4 tab, 29

Descriptors: *River ice, *Bank erosion, *Saint Lawrence Estuary, *Sedimentation, Estuarine en-vironment, Seasonal variation, Quebec, Seasonal distribution, Rivers, Erosion, Ice, Ice breakup.

The Cap-Tourment shoreline is characterized by heavy sedimentation in summer and periods of intense erosion in spring and fall. Ice plays a protective role in winter, but in the spring ice contributes to erosion, accounting for 25% of the total erosion. The sediment load of ice is approximately. 100 kg of sediment per second/sq m. Eighty-five percent of this is concentrated at the bottom, with only 15% being carried towards the estuary during the thaw. An erosion of about 2 m/yr can be measured in the banks, where the erosion is essentially hydraulic and occurs in autumn and spring. During the last season, the ice participated actively in bank destabilization, particularly wherever the cliffs along the shoreline are low. (Brock-PTT) W89-03133

HORIZONTAL AND VERTICAL DISTRIBU-TION OF PCBS IN SOUTHERN LAKE MICHI-GAN SEDIMENTS AND THE EFFECT OF WAUKEGAN HARBOR AS A POINT SOURCE, Wisconsin Univ.-Madison. Water Chemistry ProFor primary bibliographic entry see Field 5B. W89-03170

SEDIMENT TRANSPORT PREDICTION IN A TIDAL INLET USING A NUMERICAL MODEL: APPLICATION TO STONY BROOK HARBOR, LONG ISLAND, NEW YORK, USA, State Univ. of New York at Stony Brook. Marine

State Univ. of New York at Stony Brook. Marine Sciences Research Center.
G. A. Zarillo, and M.-J. Park.
Journal of Coastal Research, Vol. 3, No. 4, p 429444, Autumn 1987. 12 fig. 7 tab, 47 ref.

Descriptors: *Sediment transport, *Inlets, *Tidal basins, *New York, *Mathematical models, Estimating equations, Prediction, Numerical analysis.

Acquisition of extensive current measurements in tide-dominated environments in order to predict sediment transport is difficult and expensive. In addition, instantaneous transport rates predicted from different sediment transport equations often disagree by several orders of magnitude. Therefore a practical model was amplied to a shallow. fore, a numerical model was applied to a shallow inlet-basin system in order to make long-term pre-dictions of currents and bed shear needed to integrate instantaneous sediment transport predictions and provide realistic estimates of net transport patterns. After calibration of the model, good agreement between observed and predicted tides and currents was obtained. Five empirical sedi-ment transport equations were then coupled to the numerical model in order to compare the range of predicted sediment transport rates within the study predicted sediment transport rates within the study area. The transport rates predicted from the five different equations integrated over two spring-neap cycles result in largely flood-directed net sediment transport rates that are within one order of magnitude. The predicted net sediment transport pattern agrees well with observed conditions showing convergence of transport in shoaling areas and divergence in erosional areas. (Author's abstract) W89-03185

CHANGE IN SEDIMENTATION FOLLOWING RIVER DIVERSION IN THE EASTMAIN ES-TUARY (JAMES BAY), CANADA, McGill Univ., Montreal (Quebec). Inst. of Ocean-

Ography. B. d'Anglejan, and J. Basmadjian. Journal of Coastal Research, Vol. 3, No. 4, p 457-468, Autumn 1987. 10 fig, 1 tab, 15 ref.

Descriptors: *James Bay, *Canada, *Sedimenta-tion, *Sedimentation rates, *Estuaries, *Turbidity currents, *Diversion, Saline water intrusion, Rivers, Density flow, Canada.

Sedimentological changes that occurred in the Eastmain estuary after a 90% reduction in discharge following river diversion in July 1980 were studied during four consecutive summers. Before cut-off, the estuary was kept well flushed of river derived solids. The new sets of physical conditions led to progressive sediment retention. After July 1980, salt migration 8 km inland brought within one year the development of a turbidity maximum zone near the tip of the intrusion. This turbidity zone is unstable: suspended sediments trapped within it tend to be flushed downstream by large fluctuations in the residual flow which are caused by local precipitations or discharge control at the dam. Fine sediments accumulate at rates of 0.02 to 0.05 m per year over the pre-cut-off surface. From sediment trap data and acoustic records, it appears that sediment movement takes place by means of dilute mobile lutite suspensions close to the sediment-water interface, particularly during periods of surge in runoff. Since 1981, there has been a of surge in runoff. Since 1981, there has been a statistically significant rise in turbidity near the bottom, but not in the surface layer, suggesting a general increase in the vertical turbidity gradient. The rates of suspended sediment delivery into James Bay are at least 25 times smaller than they were before 1980. (Author's abstract) W89-03186

SEDIMENT TRANSPORT FROM DELAWARE BAY TO THE NEW JERSEY INNER SHELF, Rider Coll., Lawrenceville, NJ. Dept. of Geosci-

M. J. Hall, J. E. Nadeau, and M. J. Nicolich. Journal of Coastal Research, Vol. 3, No. 4, p 417-427, Autumn 1987. 3 fig, 2 tab, 31 ref.

Descriptors: *Tracers, *Sediment transport, *Trace metals, *Bottom sediments, *Marine sediments, *Sediment distribution, Coastal waters, Chemical analysis, New Jersey.

Trace metal analysis of bottom sediments (< 63 micron fraction) clearly indicates that Delaware-Bay-derived sediment is being deposited in waters surrounding Cape May Peninsula and northward along the inner shelf of New Jersey. Distributional patterns of trace metal values on the inner shelf show that ridge crests contain higher trace metal values than adjacent swales because exposed Pleistocene clay layers in the swales dilute the trace metal concentrations. In addition, summer sediments have metal concentrations two to three times higher than winter sediments, which may reflect the more dominant northward flowing currents in summer than in winter, or it may indicate retiect the more dominant northward thowing cur-rents in summer than in winter, or it may indicate dilution of Delaware Bay-derived clays with off-shore Pleistocene clays stirred up during winter storms. (Author's abstract) W89-03187

DISTRIBUTION OF GAMMA-EMITTING RA-DIONUCLIDES IN SURFACE SUBTIDAL SEDIMENTS NEAR THE SELLAFIELD

British Geological Survey, Keyworth (England). For primary bibliographic entry see Field 5B. W89-03190

HURRICANE-INDUCED SEDIMENT DEPOSI-TION IN A GULF COAST MARSH, California Univ., Davis. Dept. of Botany. M. Rejmanek, C. E. Sasser, and G. W. Peterson. Estuarine, Coastal and Shelf Science ECSSD3, Vol. 27, No. 2, p 217-222, August 1988. 3 fig, 1 tab,

Descriptors: *Sedimentation, *Hurricanes, *Deposition, *Coastal marshes, *Fluvial sediments, *Deltas, *Mississippi River, Sediment distribution,

Rates of sediment accumulation in four coastal marsh communities in the Mississippi River deltaic plain, Louisiana, were studied using feldspar clay marker horizons. The results indicate that normal riverine flooding contributes relatively little (< 0.1 cm/year) to marsh accretion in the studied area. In contrast, even a minor hurricane can resuspend sediments from shallow bays and deposit more than 2.2 cm of sediments in Phragmites australis dominated communities adjacent to the bayous as usummated communities adjacent to the bayous as far as 7 km inland from the bay shore. Hurricane-induced sedimentation represents at least a partial compensation to prevailing subsidence of marshes in abandoned delta lobes. (Author's abstract) W89-03193

PU(239,240) RESIDENCE TIMES IN FRESH-WATERS AND ACCUMULATION IN SHIELD LAKE SEDIMENTS, Atomic Energy of Canada Ltd., Chalk River (On-tario). Chalk River Nuclear Labs. For primary bibliographic entry see Field 2H. W89-03209

SILICA AND PHOSPHORUS FLUX FROM SEDIMENTS: IMPORTANCE OF INTERNAL RECYCLING IN LAKE MICHIGAN, Michigan Univ., Ann Arbor. Great Lakes Research Div.

For primary bibliographic entry see Field 2H. W89-03219

DYNAMICS OF LAKE MICHIGAN PHYTO-PLANKTON: RELATIONSHIP TO NITROGEN AND SILICA FLUXES, National Oceanic and Atmospheric Administra-tion, Ann Arbor, MI. Great Lakes Environmental

Chemical Processes—Group 2K

Research Lab For primary bibliographic entry see Field 2H. W89-03230

DENITRIFICATION IN FRESHWATER AND COASTAL MARINE ECOSYSTEMS: ECOLOGICAL AND GEOCHEMICAL SIGNIFICANCE, Academy of Natural Sciences of Philadelphia, PA. Div. of Environmental Research. For primary bibliographic entry see Field 2H. W89-03256

COMPARISON OF MICROBIAL DYNAMICS IN MARINE AND FRESHWATER SEDI-MENTS: CONTRASTS IN ANAEROBIC CARBON CATABOLISM,

State Univ. of New York at Stony Brook. Marine Sciences Research Center. For primary bibliographic entry see Field 2H. W89-03257

2K. Chemical Processes

LIMITS ON CATION LEACHING OF WEAKLY PODZOLIZED FOREST SOILS: AN EMPIRICAL EVALUATION, Great Lakes Forestry Research Centre, Sault Sainte Marie (Ontario). For primary bibliographic entry see Field 5B. W89-02310

SOURCES OF ALKALINITY IN PRECAMBRIAN SHIELD WATERSHEDS UNDER NAT-URAL CONDITIONS AND AFTER FIRE OR

ACIDIFICATION,
Manitoba Univ., Winnipeg. Dept. of Botany.
For primary bibliographic entry see Field 2G.
W89-02313

PROTON CYCLING IN BOGS: GEOGRAPHI-CAL VARIATION IN NORTHEASTERN NORTH AMERICA,

Minnesota Univ., Minneapolis. Dept. of Civil and Minneral Engineering. For primary bibliographic entry see Field 5B. W89-02316

EXTERNAL QUALITY-ASSURANCE RESULTS FOR THE NATIONAL ATMOSPHERIC DEPOSITION PROGRAM AND NATIONAL TRENDS NETWORK DURING 1986,

Geological Survey, Denver, CO. Water Resources For primary bibliographic entry see Field 7C. W89-02463

DIRECTORY OF PRECIPITATION MONITOR-ING SITES, NATIONAL ATMOSPHERIC DEP-OSITION PROGRAM/NATIONAL TRENDS NETWORK (NADP/NTN).

National Acid Precipitation Assessment Program, Washington, DC. For primary bibliographic entry see Field 7A. W89-02480

RECORDS OF WELLS AND CHEMICAL ANALYSES OF GROUNDWATER IN HAND AND HYDE COUNTIES SOUTH DAKOTA, Geological Survey, Huron, SD. Water Resources Div.

For primary bibliographic entry see Field 2F. W89-02505

RELATION OF WATER CHEMISTRY OF THE EDWARDS AQUIFER TO HYDROGEOLOGY AND LAND USE, SAN ANTONIO REGION, TEXAS,

Geological Survey, Austin, TX. Water Resources

For primary bibliographic entry see Field 5B. W89-02514

SUPPLEMENTAL ARSENIC DATA FOR SE-LECTED STREAMS IN THE MISSOURI RIVER BASIN, MONTANA, 1987, Geological Survey, Helena, MT. Water Resources

For primary bibliographic entry see Field 5B. W89-02516

DATA ON GROUNDWATER QUALITY FOR THE MILLETT 1 DEGREE X 2 DEGREE QUADRANGLE, CENTRAL NEVADA, Geological Survey, Carson City, NV. Water Re-For primary bibliographic entry see Field 7C. W89-02533

DATA ON GROUNDWATER QUALITY FOR THE ELKO 1 DEGREE X 2 DEGREE QUAD-RANGLE, EASTERN NEVADA, Geological Survey, Carson City, NV. Water Re-

For primary bibliographic entry see Field 7C. W89-02534

DATA ON GROUNDWATER QUALITY FOR THE ELY 1 DEGREE X 2 DEGREE QUADRAN-GLE, EASTERN NEVADA, Geological Survey, Carson City, NV. Water Re-

For primary bibliographic entry see Field 7C. W89-02535 sources Div.

DATA ON GROUNDWATER QUALITY FOR THE LUND 1 DEGREE X 2 DEGREE QUAD-RANGLE, EASTERN NEVADA, Geological Survey, Carson City, NV. Water Re-

For primary bibliographic entry see Field 7C. W89-02536

BIOGEOCHEMISTRY OF LEAD-210 AND PO-LONIUM-210 IN FRESH WATERS AND SEDI-

Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
G. Benoit, and H. F. Hemond.

G. Benoit, and H. F. Hemond. Available from the National Technical Information Service, Springfield, VA 22161 as PB88-227467/ AS. Price codes: Al0 in paper copy; A01 in micro-fiche. Water Resources Division, Final Report, (May 1988). 214p, 58 fig., 27 tab, 208 ref. Contract No. USGS 14-08-0001-G1132.

Descriptors: *Lead-210, *Polonium-210, *Sediments, *Toxic metals, *Radioactive tracers, *Biogeochemistry, Lakes, Sediments, Bickford Pond, Massachusetts, Mass balance, Geochronology, Radionuclides, Epilimnion, Fickian transport, Path of pollutants, Lake sediments, Lead radioisotropes, Polonium radioisotropes, Sediment transport.

The objective was to investigate the behavior of toxic metals in lakes and streams using the natural-ly occurring radioactive metals lead-210 and polonium-210 as tracers. The radionuclides were measutured as a function of position and time in a Massa-chusetts lake, its sediments and pore waters, and associated streams. A mass balance for the epilim-nion showed that lead-210 direct uptake by bottom non snowed that lead-210 direct uptake by bottom sediments was inconsequential. Below the epilimnion, a steep temperature/density gradient limited vertical transport. Anoxic conditions caused remobilization of iron and lead-210, which reprecipitated at the oxycline and returned to the bottom via settling. Below the oxycline, lead-210 and iron distributions resulted from constant release from anoxic sediments and dilution in the water column. Sediment lead-210 distributions were caused by sedimentation and Fickian transport. The Fickian sedimentation and Fickian transport. The Fickian component was equal to the pore water diffusive flux. In pore waters, lead-210 and polonium-210 were 100 times greater than in overlying water and had steep concentration gradients. Lead-210 partition coefficients decreased with depth, controlled by sorption on iron oxides. Remobilization to the water column comes from a thin layer of iron-rich floc near the sediment water interface. Deeper in the cores, diffusive transport can redistribute lead-

210 to an extent that can affect lead-210 dating. W89-02555

WATER QUALITY DATA (JULY 1986 THROUGH SEPTEMBER 1987) AND STATIS-TICAL SUMMARIES (MARCH 1985 THROUGH SEPTEMBER 1987) FOR THE CLARK FORK AND SELECTED TRIBUTARIES FROM DEER LODGE TO MISSOULA, MON-

Geological Survey, Helena, MT. Water Resources

For primary bibliographic entry see Field 5B. W89-02566

CONCEPT OF ELECTRON ACTIVITY AND ITS RELATION TO REDOX POTENTIALS IN AQUEOUS GEOCHEMICAL SYSTEMS,

Geological Survey, Reston, VA. Water Resources D. C. Thorstenso

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 84-072, 1984. 46p, 3 fig, 2 tab, 80 ref.

Descriptors: *Oxidation-reduction potential, *Water chemistry, *Aqueous geochemistry, *Geochemistry, *Thermodynamics, Electron activity, *Oxidation-reduction

chemistry, "Thermodynamics, Electron activity, Eh measurements.

The definition of a formal thermodynamic activity of electrons in redox reactions appears in the literature of the 1920's. The concept of pe as -log (electron activity) was introduced by Jorgensen in 1945 and popularized in the geochemical literature by Sillen, who considered pe and pH as master variables in geochemical reactions. The physical significance of the concept of electron activity was challenged as early as 1928. However, only in the last two decades have sufficient thermodynamic data become available to examine this question quantitatively. The chemical nature of hydrated electrons differs greatly from that of hydrated protons, and thermodynamic data show that hydrated electrons cannot exist at physically meaningful equilibrium concentrations under natural conditions. This has important consequences for the understanding of redox processes in natural waters. These are: (1) the analogy between pe and pH as master variables is generally carried much further than is justified; (2) a thermodynamically meaningful value of redox potential cannot be assigned to disequilibrium systems; (3) the most useful approach to the study of redox characteristics is the analysis and study of multiple redox couples in the system; and (4) for all practical purposes, thermodynamically defined redox potentials do not exist (and thus cannot be measured) in natural waters. The overall implication for natural systems is that, in terms of redox reactions, each case must be considered on an individual and detailed basis. Field studies would appear to be a mandatory part of any site-specific study; conclusions regarding redox processes cannot be based solely on electrode measurements or thermodynamic stability calculations. (USGS) W89-02580

RELATIONS OF SPECIFIC CONDUCTANCE TO STREAMFLOW AND SELECTED WATER QUALITY CHARACTERISTICS OF THE AR-KANSAS RIVER BASIN, COLORADO,

Geological Survey, Denver, CO. Water Resources D. Cain

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 87-4041, 1987. 93p, 33 fig. 1 pl, 17 tab, 18

Descriptors: *Water quality, *Specific conductivity, *Salts, *Ions, *Arkansas River, *Colorado, Regression analysis, Streamflow, Surface water, Groundwater, Data collections, Spatial variation, Seasonal variation.

Areal, seasonal, and long-term variations in the specific conductance of surface and groundwater

Group 2K—Chemical Processes

in the Arkansas River basin of Colorado were evaluated and relations of specific conductance to stream-flow and to concentrations of dissolved solids and major ions were determined as part of an effort to develop a comprehensive hydrologic model of the basin. Mean specific conductance of surface and groundwater was smallest in the upper basin and increased downstream. Smallest mean basin and increased downstream. Smallest mean specific conductance occurred during summer runoff, and largest mean specific conductance occurred during spring and fall low flows. Trends in specific conductance occurred at 18 of 31 surfacewater stations and in flow-adjusted specific con-ductance at 14 of 24 surface-water stations. Logarithmic relations of specific conductance to stream-flow were determined for 69 stations. Significant seasonal differences in the relations illustrate the effect of basin characteristics on the relation of specific conductance to streamflow. Relations of specific conductance to dissolved-solids concentra-tion were determined for 28 surface-water stations and for groundwater in alluvial aquifers along the Arkansas River. Relations of specific conductance to concentrations of major ions were determined for 26 surface-water stations and for groundwater in alluvial aquifers along the Arkansas River. (USGS) W89-02599

COMPUTER-PROGRAM DOCUMENTATION OF AN INTERACTIVE-ACCOUNTING MODEL TO SIMULATE STREAMFLOW, WATER QUALITY, AND WATER-SUPPLY OPER-ATIONS IN A RIVER BASIN,

Geological Survey, Denver, CO. Water Resources

For primary bibliographic entry see Field 7C. W89.02600

METAL SPECIATION: THEORY, ANALYSIS AND APPLICATION.

For primary bibliographic entry see Field 5B.

THERMODYNAMIC CALCULATIONS WITH SPECIAL REFERENCE TO THE AQUEOUS ALUMINUM SYSTEM,

Umea Univ. (Sweden). Dept. of Inorganic Chemis-

L. O. Ohman, and S. Sjoberg.
IN: Metal Speciation: Theory, Analysis and Application. Lewis Publishers, Chelsea, Michigan. 1988.
p. 1-40, 15 fig. 3 tab, 84 ref.

Descriptors: *Acid rain effects, *Thermodynamics, *Aluminum, *Chemical reactions, *Metal complexes, *Path of pollutants, Molecular structure, Chemical properties, Computer models, Mathematical models.

Chemical modeling based on thermodynamic calculations has potential for the understanding and
prediction of behavior of metal ions in natural
waters. Examples are given for the aluminum ion.
From having been regarded as relatively harmless,
recent findings have revealed aluminum to be one
of the most serious threats in acidified surface
waters. Equilibrium models and equilibrium constants are discussed, as well as homogeneous complexation equilibria with OH(-), inorganic ligands,
and organic ligands. Also reviewed are redox equilibria, heterogeneous equilibria, and complexation
at hydrous particle surfaces. Although much valuable information concerning the aqueous behavior
of metal ions can be obtained using different types
of linearized two-dimensional plots, a more comprehensive and unbiased treatment of a multicomprehensive and unbiased treatment of a multicom ponent, multiphase equilibrium system necessitates the use of a computerized model. A number of calculations describe the aqueous behavior of aluminum in systems of relevance to bio-uptake in man and to behavior in natural waters. Because the environmental interest in aluminum is relatively recent and its aqueous chemistry is quite compli-cated, the thermodynamic data base for this ele-ment is still incomplete. (See also W89-02640) (VerNooy-PTT) W89-02641

COORDINATION CHEMISTRY AT THE SOLID/SOLUTION INTERFACE, Stanford Univ., CA. Dept. of Civil Engineering. For primary bibliographic entry see Field 5B. W89-02642

INTRODUCTION TO INTERACTIONS OF ORGANIC COMPOUNDS WITH MINERAL SUR-FACES

Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering. For primary bibliographic entry see Field 3B. W89-02643

REACTIONS AND TRANSPORT OF TRACE METALS IN GROUNDWATER, Clarkson Univ., Potsdam, NY. Dept. of Civil and Environmental Engineering. For primary bibliographic entry see Field 5B. W89-02644

COMPARISON OF ANODIC STRIPPING VOL-TAMMETRY SPECIATION DATA WITH EM-PIRICAL MODEL PREDICTIONS OF PCU, North Carolina Univ., Chapel Hill. Dept. of Envi-ronmental Sciences and Engineering. For primary bibliographic entry see Field 7B. W89-02646

MEASUREMENTS OF BINDING SITE CON-CENTRATIONS IN HUMIC SUBSTANCES. Georgia Inst. of Tech., Atlanta. School of Geophysical Sciences.
For primary bibliographic entry see Field 7B.
W89-02647

PARTITIONING OF TRACE METALS IN SEDI-MENTS,

Quebec Univ., Sainte-Foy. For primary bibliographic entry see Field 5B. W89-02649

TRANSPORT, BIOACCUMULATION, AND TOXICITY OF METALS AND METALLOIDS IN MICROORGANISMS UNDER ENVIRON-

MENTAL STRESS,
Gray Freshwater Biological Inst., Navarre, MN.
For primary bibliographic entry see Field 5B.

METAL TREATMENT AND RECOVERY, Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering. For primary bibliographic entry see Field 5D. W89-02653

NEW DIRECTIONS IN KARST. For primary bibliographic entry see Field 2F. W89-02728

ALKALINITY MEASUREMENTS IN KARST WATER STUDIES, Lancaster Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2F. W89-02729

CONTROLS ON THE COMPOSITION OF AUTHIGENIC PERCOLATION WATER IN THE BURREN, IRELAND,

Bristol Univ. (England). Dept. of Geography.
P. L. Smart, H. Friederich, and S. T. Trudgill.
IN: New Directions in Karst. Geo Books, Norwich, England. 1986. p 17-47, 11 fig, 4 tab, 47 ref.

Descriptors: *Geochemistry, *Water chemistry, *Karst, *Caves, *Ireland, Chemical properties, Limestone, Calcium, Carbon dioxide, Percolating water, Cations, Sodium, Potassium, Magnesium, Calcareous soils, Sulfates.

Samples of authigenic percolation water were col-lected from diffuse seepages and cave drips throughout the karst area of the Burren, County

Clare, Ireland. They were subdivided into six classes, based on the soil and vegetation cover overlying the limestone, comprising Bare Pave-ments, Vegetated Pavements, Thin Mineral Soils, Calcareous Drift, Shale Drift and in situ Shale Cover. Three processes were identified as control-ling the concentration of the major ions present in ling the concentration of the major ions present in the samples: evaporative concentration of rainfall; cation exchange in the soil; and weathering of the limestone and shale bedrock. Chloride and sulfate concentrations were controlled largely by the first of these processes, although oxidation of pyrites present in the shales gave significant non-carbonate hardness from sulfuric acid. Sodium, potassium and naroness from surture acid. Sodium, potassium and magnesium concentrations were affected by cation exchange in the soil, but fertilizer applications in-creased the concentrations at Calcareous Drift sites. Calcium concentrations in most waters were controlled by the PCO2 of the overlying soil, which was highest for the thick, continuous agricultural soils, and lowest for the discontinuous gryke soils of the Bare Pavements. Ground air was important in reducing short-term temporal changes in PCO2, and ensuring open-system solution of the limestone. (See also W89-02728) (Author's abstract) W89-02730

CHEMICAL WEATHERING OF THE EAST YORKSHIRE CHALK,
London Univ. (England). Dept. of Geography.

J. I. Pitman

IN: New Directions in Karst. Geo Books, Norwich, England. 1986. p 77-113, 12 fig, 9 tab, 62 ref.

Descriptors: *Chalk, *Yorkshire, *England, *Geochemistry, *Karsthydrology, *Weathering, Aquifer characteristics, Confined aquifers, Geohydrology, Karst, Groundwater, Carbon dioxide, Ion exchange, Calcium, Sodium, Potassium, Carbonates, Nitrates, Magnesium, Chemical properties.

The chalk groundwater aquifer of East Yorkshire bits three major hydrogeochemical zones charcancing three might hydrogeochemical composi-tions. Zone 1 is coincident with the unconfined aquifer, with an area of 822 sq km. Here, Ca(+2) concentrations average 93 mg/l, HCO3(-) 235 mg/ l, and all samples are saturated with calcite at mean concentrations average 93 mg/, Pt.CO9(-)253 mg/, and all samples are saturated with calcite at mean log pCO2 of -2.02. Recharge waters (rain) contribute most of the 12.3 mg/d of SO4(-) and are acid (pH 4.83 + or - 1.55). Measured soil log pCO2 are predictable from the equation -2.50 + 0.044T for arable soils. Shallow groundwaters that are predominantly open to soil CO2, have higher Ca(+2) approximately 126 mg/l) and HCO3(-) levels (211 mg/l) and are saturated with calcite (log SIc -0.02) at an average log pCO2 of -2.08; deeper scarpfoot springs (Ca(+2) 133 mg/l) probably evolve under closed CO2 conditions (log pCO2 -2.40), and are undersaturated with calcite (log SIc-0.27). Zone 2 is the 3-5 km wide semi-confined artesian flow area on the chalk dip slope. Groundwater composition changes rapidly within this zone: (Ca+2) increases to 120 mg/l, HCO3(-) to 212-317 mg/l, with a mean log pCO2 of -1.81) associated with oxidation-reactions and ion exchange of Na(+) for mean log pCO2 of -1.81) associated with oxidation-reduction reactions and ion exchange of Na(+) for Ca(+2). This is a zone of very active solutional activity. In zone 3, the fully confined aquifer, equilibrium with calcite is maintained by a combination of cation exchange of Ca+2) for 2(Na(+) + K(+) and calcite deposition, so that dissolved Ca(+2) decreases to 70 mg/l. Carbonate ion activity is increased by increased pH and HCO3 (to 7.34 and 370 mg/l respectively) as a result of reduction of SO4(-) and No3(-). Log pCO2 is kept at -1.81 by these processes. After correction for atmospheric inputs average Ca(+2) fluxes from Givendale are 315 kg/ha/yr, equivalent to a surface lowering rate of about 39 mm in 1000 years. Chemical mass balance calculations suggest that low magnesium calcite is preferentially dissolved, with some secondary calcite precipitation. (See also W89-02728) (Author's abstract) (Author's abstract) W89-02731

PHYTOKARST, BLUE-GREEN ALGAE AND LIMESTONE WEATHERING,

University Coll., London (England). Dept. of Ge-

Chemical Processes—Group 2K

H. A. Viles, and T. Spencer. IN; New Directions in Karst, Geo Books, Norwich, England. 1986. p 115-140, 5 fig, 3 tab, 81 ref.

Descriptors: *Lichens, *Algae, *Karst, *Atolls, *Weathering, Reefs, Limestone, Phytoplankton, Carbonates, Indian Ocean, Grand Cayman Island, Intertidal areas, Colonization, Ecology, Caribbean Sea, Subtidal areas, Cyanophyta.

A micro-organic layer, dominated by blue-green algae or lichens, is found on most carbonate substrates and appears to influence limestone weathering. With advances in taxonomy and microscopy, the nature of this layer can now be more accurately defined. Studies on Aldabra Atoll, Indian Ocean and Grand Cayman Island, Caribbean Sea, have and Grand Cayman Island, Caribbean Sea, nave shown that algal colonization rates are rapid in subtidal and intertidal environments. However, subtilization rates are much slower on subaerial surfaces and it is unlikely that phytokarst land-scapes are solely the product of blue-green algae. (See also W89-02728) (Author's abstract) W89-02732

CHEMICAL EROSION IN TOWER KARST TERRAIN, KINTA VALLEY, PENINSULAR MALAYSIA, Saint David's Univ. Coll., Lampeter (Wales).

Dept. of Geography.
For primary bibliographic entry see Field 2J.
W89-02738

RAPID SUBSURFACE FLOW AND STREAM-FLOW SOLUTE LOSSES IN A MIXED EVER-GREEN FOREST, NEW ZEALAND, Ministry of Works and Development, Christ-church (New Zealand). For primary bibliographic entry see Field 2G. W89-02890

HYDROLOGY AND SOLUTE UPTAKE IN HILLSLOPE SOILS ON MAGNESIAN LIME-STONE; THE WHITWELL WOOD PROJECT, Sheffield Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2G. W89-02891

DYNAMICS OF WATER CHEMISTRY IN HARDWOOD AND PINE ECOSYSTEMS, Southeastern Forest Experiment Station, Asheville, NC. Cowete Hydrologic Lab. W. T. Swank, and W. T. S. Scott-Swank. IN: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 35-346, 6 tab, 33 ref. NSF grant DEB 7904537.

Descriptors: *Soil-water plant relationships, *Forest hydrology, *Water chemistry, *Soil water, *Weathering, *Geomorphology, Ecosystems, Pine trees, Hardwood, Soils, Denudation, Seasonal vari-ation, Forests, Vegetation, Fluvial geomorpho-logy, Soil chemistry, Ions.

The seasonal changes in water chemistry during the passage of water through one mixed hardwood and two different pinewood forests in the United States are described. The greatest change in ion concentrations occurs during the growing season when plant uptake and other biological processes are most active. Patterns of cation changes through compartments are generally similar for the three forest types, but there are a few exceptions. Patterns are most different for ions such as NO3 and SO4 which are mediated by microbial transformations. The forest canopy and litter-soil interface are major compartments of ion exchange. The presence, absence, and type of forest vegetation can substantially alter the chemical composition of water before it reaches the underlying saprolite rock and bedrock. These alterations may influence weathering rates and solutional denudation. (See also W89-02880) (Author's abstract)

VARIABLE SOLUTE SOURCES AND HYDRO-LOGICAL PATHWAYS IN A COASTAL SUB-ALPINE ENVIRONMENT,

T. M. Gallie, and H. O. Slaymaker. In: Catchment Experiments in Fluvial Geomorphology. Geo Books, Norwich, England. 1984. p 347-357, 2 fig, 1 tab, 15 ref.

Descriptors: *Soil-water-plant relationships, *Solute transport, *Water chemistry, *Forest hydrology, *Geomorphology, *Soil waters, Soils, Vegetation, Watersheds, Hydrology, Solutes, Fluvial geomorphology, Catchment areas, Canada, Coastal streams, Alpine regions.

Sources and pathways of solutes within a 2 ha subalpine watershed in southwestern British Co-lumbia are described. Observations indicate that water flowpaths are non-uniform in time and space. Spatial sampling of solutes confirms that surface, soil and groundwater movements and mixing are complex phenomena. It is concluded that soil-vegetation complexes are rational sam-pling units for hydrologic process studies in small watersheds, that unsaturated transient saturated pling units for hydrologic process studies in small watersheds, that unsaturated, transient saturated and permanently saturated soil water zones are useful solute sampling units, and that channel-based sampling programs should supplement rather than supercede slope-based sampling programs. (See also W89-02880) (Author's abstract) W89-02901

HYDROCHEMICAL CHARACTERISTICS OF A

DARTMOOR HILLSLOPE,
Plymouth Polytechnic (England). Dept. of Geo-Frynduch Folytechnic (England). Dept. of graphical Sciences.
For primary bibliographic entry see Field 2E. W89-02903

CHARACTERIZATION OF COLLOIDS IN

CHARACTERIZATION OF COLLOUIS IN GROUNDWATER, Technische Univ. Muenchen, Garching (Germany, F.R.). Lehrstuhl und Inst. fuer Radiochemie. J. I. Kim, G. Buckau, and R. Klenze. Available from the National Technical Information Service, Springfield, VA 22161, as DE88-752265. Price codes: A03 in paper copy, A01 in microfiche. Report No. RCM 01687, July 1987. 29p, 14 fig. 1 tab, 14 ref. MIRAGE Contract FI 1W-0067-D(B).

Descriptors: *Colloids, *Water chemistry, *Groundwater chemistry, *Geochemistry, *Laser induced photoacoustic spectroscopy, Aquifers, Chemical analysis, Humic acids, Heavy metals,

Natural colloids in the Gorleben aquifer systems were investigated for their chemical composition, quantification and size distribution. Humic substances appear to be the major organic materials in stances appear to be the major organic materials in these groundwaters, generating humic colloids which were identified as humic acid (and fulvic acid) loaded with a large number of trace metal ions. These metal ions include natural homologues of actinides and some fission products in trivalent, tetravalent and hexavalent state. Concentrations of trivalent and tetravalent heavy metal ions are linearly correlated with the dissolved organic carbon (DOC) concentration in different groundwaters. The DOC was present as humic colloids. The Am(3+) ions introduced in such a groundwater readily undergo the generation of its pseudocolreadily undergo the generation of its pseudocol-loids through sorption or ion exchange reactions with humic colloids. The chemical behavior of with humic colloids. The chemical behavior of Am(III), being similar to the trivalent metal ions, e.g. Fe(3+), REE etc. found in natural colloids, was investigated by laser induced photoacoustic spectroscopy (LPAS). The quantification of colloids in three different groundwaters (from Ispra, Markham Clinton and Felslabor Grimsel) was also studied by LPAS. Bi-distilled water and one of the Gorleben groundwaters, Goby 1011, were used for comparison. This groundwater contains the least comparison. This groundwater contains the least amount of natural colloids of all Gorleben groundwaters investigated. An indirect quantification is made by comparison of the LPAS results with experiment from Latex solution. (Lantz-PTT) W89-02998

HYDROGEOCHEMISTRY OF THE UPPER PART OF THE FORT UNION GROUP IN THE GASCOYNE LIGNITE STRIP-MINING AREA, NORTH DAKOTA,

For primary bibliographic entry see Field 4C. W89-03026

HYDROLOGY AND CHEMISTRY OF SELECTED PRAIRIE WETLANDS IN THE COTTON-WOOD LAKE AREA, STUTSMAN COUNTY, NORTH DAKOTA, 1979-82, Geological Survey, Lakewood, CO. For primary bibliographic entry see Field 2H.

ATMOSPHERIC, GEOLOGICAL, MARINE, AND ANTHROPOGENIC EFFECTS ON GROUNDWATER QUALITY IN FINLAND, Geologian Tutkimuskeskus, Espoo (Finland). Dept. of Geochemistry. For primary bibliographic entry see Field 5B. W89-03076

CLOGGING PROBLEMS IN GROUNDWATER HEAT PUMP SYSTEMS IN SWEDEN, Chalmers Univ. of Technology, Goeta (Sweden). Dept. of Geology. For primary bibliographic entry see Field 2F. W89-03089 Goetebore

FATE OF ADDED ALKALINITY DURING NEUTRALIZATION OF ACID LAKE, Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.

For primary bibliographic entry see Field 5G. For primar W89-03111

TEMPERATURE DEPENDENCE OF LIQUID FILM COEFFICIENT FOR GAS TRANSFER, Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
E. I. Daniil, and J. S. Gulliver.
Journal of Environmental Engineering (ASCE) JOEDDU, Vol. 114, No. 5, p 1224-1229, October 1988. 1 fig, 16 ref. NSF Grant.

Descriptors: *Mathematical models, *Aeration, *Path of pollutants, *Fate of pollutants, Gas transfer, Temperature dependency, Schmidt number, Surface film, Correction factors.

Gas transfer between the atmosphere and underlying water bodies is important because it affects water quality, climate, and the fate of toxic pollutants. Physical properties of the liquid and gas phases that influence gas transfer are temperature dependent. Empirical equations are usually used to account for the temperature variation. Models for the temperature correction factor are compared and their corresponding applicabilities are determined. From this comparison of models and equations for the prediction of a temperature correction factor, it is concluded that an equation with a dependence, derived theoretically and verified experimentally, is the appropriate one to be used for dependence, derived theoretically and verified experimentally, is the appropriate one to be used for the conversion of data from one temperature to another. The equation currently used, which is a purely empirical equation for oxygen transfer, gives nearly identical results. The dependence on the square root of Sc indicates that the temperature correction factor is the same for all gases, since it depends only on water properties. In addition, it allows the translation of gas transfer coefficients between various gases. (Brock-PTT)

INTERACTIONS OF ORGANIC MATTER AND ALUMINUM IONS IN ACID FOREST SOIL SOLUTIONS: METAL COMPLEXATION, FLOCCULATION, AND PRECIPITATION, FLOCCULATION, AND PRECIPITATION, Goettingen Univ. (Germany, F.R.). Inst. fuer Bodenkunde und Waldernaehrung.

J. Ares, and W. Ziechman.
Soil Science SOSCAK, Vol. 145, No. 6, p 437-447, June 1988. 5 fig. 3 tab. 22 ref.

Descriptors: *Soil chemistry, *Forest soils, *Acidity, *Organic matter, *Aluminum, Potentiometers, Precipitation, Flocculation, Metal complexation, Lysimeters, Hydrogen ion concentration.

Group 2K—Chemical Processes

F potentiometry was used to analyze samples of ultrafiltered organic material obtained from lysimeter solutions during a growing season in two forest soils of different acidity. F potentiometry is a newly developed technique that allows the speciation of Al in the presence of complexes of untion of Al in the presence of complexes of un-known thermodynamic characteristics. The sam-ples were analyzed for the amount of bound Al after known amounts had been added. All samples were separately studied with gel chromatography, to quantify the occurrence of precipitation and flocculation phenomena. These were performed after buffering the samples to the pH ranges usual-ly occurring in the soil solution during a growing season. The original pH of the samples and the Al content were also measured. Results regarding the intensity of Al binding and the formation of preci-pitates in 62 samples are shown. The variance of intensity of Al binding and the formation of precipitates in 62 samples are shown. The variance of the variable describing the intensity of precipitation was significantly split among the different factors affecting it, namely the pH of the treatment, the amounts of bound and free Al, and a covariant representing unspecified site differences.
All these factors are important in defining the All tiese factors are important in terming in the precipitation and mobility of the organic matter in the solution of the upper forest soils studied. These have implication for the interpretation of processes related to organic matter turnover and Al mobility in the upper soil. (Author's abstract) W89-03126

XANTHENE DYE CHEMILUMINESCENCE FOR DETERMINATION OF FREE CHLORINE IN WATER,

Tokyo Metropolitan Univ. (Japan). Dept. of Industrial Chemistry.
For primary bibliographic entry see Field 7B.
W89-03183

CYCLING OF METHANE, CARBON MONOXIDE, NITROUS OXIDE, AND HYDROXYLAMINE IN A MEROMICTIC, COASTAL LAGOON,
Oregon State Univ., Corvallis. Coll. of Oceanogra-

phy. For primary bibliographic entry see Field 2L. W89-03191

HYDROGEN (H2) DISTRIBUTIONS IN THE CARMANS RIVER ESTUARY,

State Univ. of New York at Stony Brook. Marine Sciences Research Center. For primary bibliographic entry see Field 2L. W89-03194

PU(239,240) RESIDENCE TIMES IN FRESH-WATERS AND ACCUMULATION IN SHIELD LAKE SEDIMENTS,

Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs. For primary bibliographic entry see Field 2H. W89-03209

PREDICTION OF PHOSPHORUS RELEASE RATES FROM TOTAL AND REDUCTANT-SOLUBLE PHOSPHORUS IN ANOXIC LAKE SEDIMENTS, York Univ., Downsview (Ontario). Faculty of Sci-

For primary bibliographic entry see Field 2H. W89-03210

EFFECT OF PH ON SPECIATION AND TOX-ICITY OF ALUMINUM TO RAINBOW TROUT (SALMO GAIRDNERI), Alberta Environment, Edmonton. Standards and

Approvals Div.
For primary bibliographic entry see Field 5C.
W89-03213

EFFECTS OF LIMING ON THE DISTRIBU-TION OF CADMIUM IN WATER, SEDIMENT, AND ORGANISMS IN A SWEDISH LAKE, National Swedish Environment Protection Board. Solna. Trace Metal Lab.
For primary bibliographic entry see Field 5B.

W80.03224

SCALED CHRYSOPHYTES (CHRYSOPHY-CEAE) AS INDICATORS OF PH IN SUDBURY,

ONTARIO, LAKES, Trent Univ., Peterborough (Ontario). Trent Aquatic Research Centre. For primary bibliographic entry see Field 5A. W89-03227

PHOSPHOROUS FLUX FROM LAKE SEDI-MENTS: EFFECT OF EPIPELIC ALGAL OXYGEN PRODUCTION, Michigan State Univ., Hickory Corners. W.K. Kellogg Biological Station. For primary bibliographic entry see Field 2H. W89-03248

METHANE CYCLING IN THE SEDIMENTS OF LAKE WASHINGTON, Washington Univ., Seattle. School of Oceanogra-

phy.
For primary bibliographic entry see Field 2H.
W89-03249

KINETIC CONTROL OF DISSOLVED PHOS-PHATE IN NATURAL RIVERS AND ESTU-ARIES: A PRIMER ON THE PHOSPHATE BUFFER MECHANISM, Lamont-Doherty Geological Observatory, Pali-

sades, NY. P. N. Froelich.

Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 2, p 649-668, July 1988. 7 fig, 6 tab, 103

Descriptors: *Water chemistry, *Sorption, *Nutrient transport, *Rivers, *Estuaries, *Phosphates, Reviews, Kinetics, Adsorption.

Information is reviewed concerning the phosphate Information is reviewed concerning the phosphate buffer mechanism as a significant natural process in transporting potentially available phosphorus to the sea. The systematics of phosphate buffering reactions with an emphasis on the first order biogeochemical implications for natural, unperturbed systems is described. The extent to which phosphate concentrations are controlled by phosphate buffering is evaluated and the quantitative flux of particulates is estimated. The release of sorbed phosphate to estuarine waters is quantified and phosphate to estuarine waters is quantified and phosphate to estuarne waters is quantined and compared with observations in natural estuaries. The primary mode of interaction of dissolved phosphate with fluvial inorganic suspended parti-cles is via a reversible two-step sorption process. cles is via a reversible two-step sorption process. The first step, adsorption/desorption on surfaces, has fast kinetics (minutes-hours). The second step, solid-state diffusion of adsorbed phosphate from the surface into the interior of particles, has slow kinetics (days-months) and is dependent on the time history of the previous surface sorption and the chemistry of the solid diffusional layer. Natural clay particles with a surficial armoring of reactive iron and aluminum hydroxyoxides resulting from chemical weathering of rocks and soils have a high capacity for absorbing phosphate in the second step and for maintaining low 'equilibrium phosphate concentrations' in solution. Extrapolation of laboratory sorption and extraction experiments with natural soils and suspended sediments to the environment suggests that the phosphate concenenvironment suggests that the phosphate concentrations of unperturbed turbid rivers are controlled near the dynamic equilibrium phosphate concentration of their particles and that fluvial suspended particles 'at equilibrium' contain up to 10 micromol-P/g that is desorbable. Release of this phosphate from particles entering the sea produces the characteristic shape and magnitude of input profiles of dissolved phosphate observed in unperturbed estuaries. On a global scale, fluvial particulates could transport from 1.4 to 14 times 10 to the tenth power mol/yr of reactive phosphate to the sea, some 2.5 times more than that in the dissolved load alone. (Miller-PTT)

NITROGEN FIXATION IN FRESHWATER, ESTUARINE, AND MARINE ECOSYSTEMS: 1. RATES AND IMPORTANCE,

Cornell Univ., Ithaca, NY. Section of Ecology and Systematics. For primary bibliographic entry see Field 2H.

NITROGEN FIXATION IN FRESHWATER, ESTUARINE, AND MARINE ECOSYSTEMS: 2. BIOGEOCHEMICAL CONTROLS,

Cornell Univ., Ithaca, NY. Section of Ecology and Systematics.

For primary bibliographic entry see Field 2H.

FACTORS CONTROLLING THE BIOGEOCHE-MICAL CYCLES OF TRACE ELEMENTS IN FRESH AND COASTAL MARINE WATERS AS REVEALED BY ARTIFICIAL RADIOISO-TOPES.

Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Due-bendorf (Switzerland).

For primary bibliographic entry see Field 2H. W89-03263

W89-03278

IODINE SPECIATION IN CHESAPEAKE BAY WATERS.

Delaware Univ., Lewes. Coll. of Marine Studies. For primary bibliographic entry see Field 2L. W89-03277

MASS BALANCE OF HEAVY METALS IN THE SETO INLAND SEA, JAPAN,

Government Industrial Research Inst., Chugoku, Kure (Japan). For primary bibliographic entry see Field 5B.

DETERMINATION OF TIN IN ENVIRON-MENTAL SAMPLES BY GRAPHITE FURNACE ATOMIC ABSORPTION AND INDUCTIVELY COUPLED PLASMA-MASS SPECTROMETRY, Toronto Univ. (Ontario). Dept. of Geology. For primary bibliographic entry see Field 5A. W89-03303

DEGRADATION OF BROMOFORM AND CHLORODIBROMOMETHANE IN A CATA-LYZED H2-WATER SYSTEM,

Harbor Branch Oceanographic Institution, Inc.,

Harbor Branch Oceanographic Institution, Inc., Fort Pierce, FL.
T. C. Wang, C. K. Tan, and M. C. Liou.
Bulletin of Environmental Contamination and
Toxicology BECTA6, Vol. 41, No. 4, p 563-568,
October 1988. 4 fig, 2 tab, 11 ref.

Descriptors: *Methane, *Adsorption, *Catalysts, *Halogens, *Chemical reactions, Bromoform, Langmuir adsorption model, Trihalomethanes,

The Langmuir adsorption model was applied to describe the reaction mechanism of CH4 generated from trihalomethanes in a hydrogen enriched enclosure. Blank tests with CHBr3 and CHClBr2 in crosure. Brank tests with CHBr3 and CHClBr2 in the H2-water system without catalysts were per-formed. The samples analyzed after 24 hours of agitation showed that most of the starting sub-strates were not completely reduced to CH4. Ap-proximately 5% and 18% of both substrates were proximately 5% and 18% of both substrates were reduced to CH4, respectively. The results indicate that hydrogen alone is not an effective reducing reagent. In this reduction study, H2 molecules introduced into the catalyst particle could be disassociated with metal bonded hydrogen atoms. These active species, surface-bound atoms, could then reduce the halogenated methanes to CH4. The reduction of CH3 to CH4 can be described as the formation of the adsorbed CHX3 on the catalyst sites and follows a simple Langmuir isotherm behavior. It is shown that colloidal platinum is an effective catalyst in reducing CHX3 to CH4 in a H2 enriched enclosure at room temperature. The Langmuir adsorption model can be applied to this reduction process. (Miller-PTT)

Estuaries—Group 2L

2L. Estuaries

MULTIDECADE TREND-MONITORING PROGRAM FOR CHESAPEAKE BAY, A TEMPER-ATE EAST COAST ESTUARY, Environmental Protection Agency, Annapolis,

MD. Chesapeake Bay Program.
For primary bibliographic entry see Field 7A.
W89-02324

ESTUARINE INVERTEBRATES AND FISH: SAMPLING DESIGN AND CONSTRAINTS FOR LONG-TERM MEASUREMENTS OF POPULATION DYNAMICS, Smithsonian Environmental Research Center,

Smithsonian Environmental Research Center, Edgewater, MD. A. H. Hines, P. J. Haddon, J. J. Miklas, L. A. Wiechert, and A. M. Haddon. IN: New Approaches to Monitoring Aquatic Eco-systems. American Society for Testing and Materi-als, Philadelphia, PA. 1987. p 140-164, 11 fig, 4 tab,

Descriptors: *Monitoring, *Data collection, *Ecosystems, *Chesapeake Bay, *Population dynamics, Estuaries, Fish, Long-term planning, Invertebrates.

The first 5 to 6 years of a long-term data set are presented for invertebrates and fish representing an array of physiological tolerances, trophic levels, and life history strategies in a lower mesohaline subestuary of Chesapeake Bay. Population abundances were estimated for infaunal invertebrates, for nearshore fish, and for epibenthic fish and crabs. Physical/chemical parameters of estuarine water were monitored continuously. Variation aswater were monitored continuously. Variation as-sociated with seasonal cycles was accounted for, and the effects of year, station, and salinity on population abundances was tested. The study period spanned a multiyear period of regional drought in the 1980s, which resulted in markedly increased salinities and reflected a greater devi-ation from the long-term average than reduced salinities during the major storms of the 1970s. Analysis of variance and covariance models ac-counted for 12 to 2000, of the variation in papels. Analysis of variance and covariance models accounted for 12 to 82% of the variation in population abundance, depending on the species. All but two species showed significant differences in population abundances among years for 19 infaunal invertebrate species, 18 species of nearshore fish, and 5 species of epibenthic fish and crabs. Most species exhibit severalfold differences in abundances among years. About half of the infaunal species, several of the nearshore fish, and 4 epibenthic species showed significant responses to elevated salinities. However, despite the overall importance of salinity on estuarine systems, only a small fraction of the variation in any one species small fraction of the variation in any one species was explained by salinity change (1 to 6%). Several possible factors that explain the failure to account for more of the population variation by salinity are listed. (See also W89-02317) (Author's abstract) W89-02327

DEVELOPMENT, MANAGEMENT, AND ANALYSIS OF A LONG-TERM ECOLOGICAL RESEARCH INFORMATION BASE: EXAMPLE FOR MARINE MACROBENTHOS, South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research. For primary bibliographic entry see Field 10D. W89-02329

HYDROGEOLOGICAL MAPPING IN COAST-

Rijks Geologische Dienst, Haarlem (Netherlands). For primary bibliographic entry see Field 2F. W89-02390

DATA ON THE DISTRIBUTION AND ABUN-DANCE OF SUBMERSED AQUATIC VEGETA-TION IN THE TIDAL POTOMAC RIVER AND ESTUARY, MARYLAND, VIRGINIA, AND THE DISTRICT OF COLUMBIA, 1986, Geological Survey, Reston, VA. Water Resources

For primary bibliographic entry see Field 7C.

W89-02511

FLOW SIMULATION MODEL OF THE TIDAL POTOMAC RIVER,
Geological Survey, Reston, VA. Water Resources

Div. R. W. Schaffranek

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Supply Paper 2234-D, 1987. 41p, 15 fig, 4 tab, 5 ref.

Descriptors: *Potomac River, *Tidal flushing, *Estuaries, *Model studies, Flow model, Transport, Tides, Water circulation, Simulation.

A one-dimensional model capable of simulating flow in a network of interconnected channels has flow in a network of interconnected channels has been applied to the tidal Potomac River including its major tributaries and embayments between Washington, D.C. and Indian Head, Md. The model can be used to compute water-surface elevations and flow discharges at any of 66 predetermined locations or at any alternative river cross sections definable within the network of channels. It additions the world can be used to previde the productions of the In addition, the model can be used to provide tidal-In addition, the model can be used to provide tidal-interchange flow volumes and to evaluate tidal excursions and the flushing properties of the river-ine system. Comparisons of model-computed re-sults with measured water-surface elevations and discharges demonstrate the validity and accuracy of the model. Tidal-eycle flow volumes computed by the calibrated model have been verified to be within an accuracy of plus or minus 10 percent. Quantitative characteristics of the hydrodynamics Quantitative characteristics of the hydrodynamics of the tidal river are identified and discussed. The comprehensive flow data provided by the model can be used to better understand the geochemical, biological, and other processes affecting the river's water quality. (USGS)
W89-02529

HYDRODYNAMICS OF ESTUARIES, VOLUME I: ESTUARINE PHYSICS. South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research. CRC Press, Boca Raton, FL. 1988. 163p. Edited by Bjorn Kjerfve.

Descriptors: *Estuaries, *Hydrodynamics, Topography, Physical properties.

This book is one of two volumes which attempt to summarize many of the prevalent concepts and approaches in the investigation into hydrodynaapproaches in the investigation into hydrodyna-mics and physical processes of estuaries. This first volume focuses on estuarine physics and physical processes and interpretations. Engineering applica-tions to estuaries are, for the most part, intentional-ly downplayed. These books should prove useful to occanography students, research workers in the field, and to persons charged with the management of estuarine resources. (See W89-02683 thru W89-02692) (Davis-PTT)

DYNAMICS OF PARTIALLY MIXED ESTU-

State Univ. of New York at Stony Brook. Marine Sciences Research Center. R. E. Wilson.

R. E. WIISON.
IN: Hydrodynamics of Estuaries, Volume I: Estuarine Physics. CRC Press, Boca Raton, FL. 1988. p
1-15, 11 fig, 10 ref.

Descriptors: *Estuaries, *Hydrodynamics,
*Mixing, Water circulation, Tides, Density, Turbu-*Hydrodynamics,

A review of the most basic physical processes controlling the residual nontidal circulation in a partially mixed estuary is presented. Simple momentum and salt balance equations represent the major features in the vertical structure of observed nontidal currents and salinity defect. Research into estuarine dynamics focuses on some of the very complex problems involving the description of residual flow by nonlinear terms in the equation of sidual flow by nonlinear terms in the equation of motion and through bottom friction. This includes the interactions between the tidal flow and density structure due to the influence of stratification on

tidally induced turbulence and mixing. (See also W89-02682) (Davis-PTT) W89-02683

DYNAMIC CONTROL BY TOPOGRAPHY IN

Goeteborg Univ. (Sweden). Dept. of Oceanography.

A. Stigebrandt. IN: Hydrodynamics of Estuaries, Volume I: Estua-rine Physics. CRC Press. Boca Raton, FL. 1988, p. 17-26, 4 fig. 16 ref.

Descriptors: *Water circulation, *Hydrodynamics, *Channel morphology, *Estuaries, *Topography, Tidal effects, Circulation, Freshwater, Seawater,

Important ways in which topography controls the stratification and circulation in estuaries are sum-marized. Since freshwater is less dense than sea-water, the freshwater tends to accumulate at the water, the freshwater tends to accumulate at the top of the water body. In order to efficiently mix freshwater into seawater, turbulent mixing processes must be active. Whether or not an estuary will be well-mixed depends upon the magnitude of the supply of buoyancy and the intensity of the vertical mixing. A topographical constriction will decrease the horizontal exchange. The flow of buoyancy out of an estuary is often driven by horizontal pressure gradients caused by horizontal pressure gradients caused by horizontal accidents. ancy out of an estuary is often driven by horizontal pradients in buoyancy. The lighter water tends to flow out of the estuary and creates a light layer also outside the estuary. In some estuaries the fluctuating tidal velocities are larger than the baroclinic velocities. Barotropic currents in the mouth, caused by sea level variations outside the mouth of the estuary may disturb the steady baroclinic circulation. Serious disturbances will occur when fluctuating baro-tropic currents have amplitudes larger than the baroclinic velocities calculated for the steady baroparoctime vetocines calculated for the steady baro-clinic estuarine circulation. The baroclinic dynam-ic control in the mouth is eliminated for shorter or longer periods by the fluctuating barotropic cur-rent, and during these periods there is essentially only one water mass present in the mouth. (See also W89-02682) (Davis-PTT) W89-02684

DISPERSION IN SHALLOW ESTUARIES,

Rosenstiel School of Marine and Atmospheric Science, Miami, FL. Div. of Applied Marine Physics. J. van de Kreeke.

In: Hydrodynamics of Estuaries, Volume I: Estuarine Physics. CRC Press, Boca Raton, FL. 1988. p 27-39, 6 fig, 29 ref.

Descriptors: *Shallow water, *Dispersion, *Estuaries, *Water currents, Tidal effects, *Mixing, Circulation, Freshwater, Turbulence.

Tides and tidal currents, vertical velocity distribution residual currents, vertical wiconzy distribu-tion residual currents, vertical mixing, dispersion, the advection-dispersion equation for shallow water, and residence time are discussed with re-spect to dispersion in shallow estuaries. An estuary spect to dispersion in shallow estuaries. An estuary is defined as a semi-enclosed body of water. Tides and tidal currents are generated by the combined action of the attractive forces of primarily the moon and the rotation of the earth-moon system about their common center of gravity. The tidal current implies the vertically averaged current. The residual current or residual circulation is what remains of the velocity field after the tidal currents have been removed. Residual circulations in shallow estuaries are the results of wind pontifal low estuaries are the results of: wind, nontidal forcing at the seaward boundary, nonlinear interaction within the estuary of incoming and reflected tidal waves, nonlinear interaction of the tidal waves and varying bottom topography in the estuary, and inflow of freshwater. Vertical mixing is associated with turbulence. In shallow waters turbulence is primarily a result of bottom friction. The time a particle released at a location resides in an estuary is referred to as the transit time. The transit time depends on the phase of the tide at which the particle is released. (See also W89-02682) (Davis-

Group 2L—Estuaries

TIDALLY GENERATED ESTUARINE MIXING

PROCESSES, Plymouth Polytechnic (England). Inst. of Marine

K. R. Dver R. R. Dyer. IN: Hydrodynamics of Estuaries, Volume I: Estua-rine Physics. CRC Press, Boca Raton, FL. 1988. p 41-57, 8 fig, 49 ref.

Descriptors: *Tidal hydraulics, *Estuaries, *Mixing, Turbulence, Waves, Wave energy, Currents, Internal waves.

Mixing in estuaries is caused by turbulence produced both by the velocity shear resulting from bottom friction and by internal shear. The balance bottom friction and by internal shear. The balance between the two varies, the former being dominant in well-mixed estuaries, and the latter in highly stratified estuaries. Since the mixing processes are small in scale and fast in action, it is difficult to measure them directly. Much of the information about them is through extrapolation from laboratory experiments, or by inference. In turbulent flow the velocities are constantly fluctuating in magnitude and direction. Internal waves are often produced by the interaction of stratified flow with tude and direction. Internal waves are often pro-duced by the interaction of straiffied flow with topography. For most tidal situations the gradually accelerating flow over a step in bed level will produce a series of lee waves whose phase velocity upstream just balances the flow velocity. The lee waves with shorter wavelengths are gradually displaced downstream by waves of larger amplitude and wavelengths as the velocity increases. As critical internal Froude number conditions are apcai internal rrouge number conditions are approached the wave energy is concentrated close to the step, the amplitude of the waves grows, and they break as an internal hydraulic jump creating active mixing which is then advected downstream. active mixing which is then advected downstream. Internal waves traveling along the estuary after generation and release may encounter a high velocity ebb current, and break. Once they break they appear to form elongated interfaces sloping gradually upward in a down-estuary direction. If there is a regular forcing under subcritical conditions by tidal flow over a step, waves are produced by both phases of the current and move in opposite directions. Internal waves may be important features of mixing processes in estuaries, especially because their generation sites and the positions where they cause mixing may be so separate in space and in time. (See also W89-02682) (Davis-PTT) W89-02686

TIDAL DYNAMICS OF ESTUARIES Institute for Marine Environmental Research, Plymouth (England).

R. J. Uncles.

IN: Hydrodynamics of Estuaries, Volume I: Estuarine Physics. CRC Press, Boca Raton, FL. 1988. p 59-73, 6 fig, 9 ref.

Descriptors: *Hydrodynamics, *Estuaries, *Tidal hydraulics, Bristol Channel, Severn Estuary, Currents, Waves, Stokes Drift, Mixing.

The hydrodynamics of strongly tidal, well-mixed, and partly-mixed estuaries are discussed. The discussion is based largely on numerical solutions of cussion is based largely on numerical solutions of the equations governing tidal flows in shallow water, and makes use of data computed for the macrotidal Bristol Channel and Severn Estuary, a well-mixed estuarine system in the southwest of well-mixed estuarine system in the southwest of the U.K. The elevations and currents within an estuary are not perfect sine waves, but exhibit distortion or asymmetry between flood and ebb elevations and currents. This feature is due to the presence of overtide which are higher tidal har-monics of the fundamental tide. Because boundary currents and nonlinear currents dominate near the mouth, and near the head, respectively, the tidal curve is ebb-dominant near the mouth of the Severn, and flood-dominant in the upper reaches. The flood-dominance of the tidal currents has been observed in the upper reaches of many strongly tidal estuaries. Nonlinearities in the tidal dynamics not only introduce asymmetry into the elevations and currents, but also lead to a shift in mean sea level. Mean sea level increases progressing upestuary, even in absence of density gradients. This is a consequence of frictional drag at the seabed. Friction manifests itself in two ways: first, by causing the tide to be partially progressive and intro-ducing a Stokes drift, and second, by introducing asymmetry into the tidal currents. (See also W89-02622) (Davis-PTT) W89-02687

ESTUARINE RESIDENCE TIMES, Utrecht Rijksuniversiteit (Netherlands). Inst. voor Meteorologie en Oceanografie. J. T. F. Zimmerman. IN: Hydrodynamics of Estuaries, Volume I: Estuarine Physics. CRC Press, Boca Raton, FL. 1988. p 75-84, 4 fig, 1 tab, 6 ref.

Descriptors: *Residence times, *Estuaries, *Discharge, Netherlands, Saline-freshwater interfaces, Flushing, Water circulation, Mixing.

The residence time of an estuary is loosely defined as the average time a water parcel spends in the estuarine system. A time scale analysis is applied to various estuarine systems in the Netherlands. The estuary of the river Ems consists of a wide section estuary of the river Ems consists of a wide section and two branches, one of which gradually goes over into the river Ems, whereas the other one, the Dollard, is a broad tidal flat with a narrow gully, at the end of which a small freshwater discharge is present. The river Ems has a seasonally strongly varying discharge of 50 to 350 cu m/sec. The fluctuating discharge has a pronounced effect on the flushing time scale of Ems water derived from the salinity distribution. The river section is dominated by advection for all discharges. The salinity distribution at high and low river discharge demonstrates an accordance with the intrusion length scales. The distribution of the local residence times equals that of the age of seawater. (See also W89-02682) (Davis-PTT) W89-02688

ESTUARINE FRONTS,

State Univ. of New York at Stony Brook. Marine Sciences Research Center. M. J. Bowman.

N. J. Bowman. IN: Hydrodynamics of Estuaries, Volume I: Estua-rine Physics. CRC Press, Boca Raton, FL. 1988. p 85-132, 45 fig, 48 ref.

Descriptors: *Saline-freshwater interfaces, *Estuaries, *Mixing, *Estuarine fronts, Model studies, Circulation, Water circulation.

Some of the important physical processes that operate in several types of estuarine fronts are explained. The emergence of a mixing model based on the h/cu microns stratification index originally derived for study of shelf sea fronts has provided a theoretical framework around which to construct a better understanding of vertical mixing and the physics of tidal mixing estuarine fronts. Fronts in estuaries play an important role in estuarine dynamics, and must be included in any comprehensive dynamical description of circulation and mixing. The importance of estuarine fronts becomes most apparent when their biological significances. mixing. The importance of estuarine fronts oc-comes most apparent when their biological signifi-cance is realized. High data density sampling sur-veys using modern instrumentation have provided a much clearer understanding of the great com-plexity of mixing processes in estuaries. More re-resers in medical to execute the medical control and the conplexity of mixing processes in estuaries. More re-search is needed to construct predictive models of estuarine circulation and mixing at scales capable of resolving the details of frontal dynamics. Fur-ther studies are also needed to test the tidal mixing frontal theory at differing seasons, and in other estuaries of varying scales, latitudes, runoff, and geomorphology. (See also W89-02682) (Davis-PTT)
W89-02689

MODELING OF TIDALLY INDUCED RESIDU-

MODELING OF TIDALLY INDUCED RESIDU-AL CURRENTS,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Dept. of Fisheries and Oceans.
K. T. Tee.
IN: Hydrodynamics of Estuaries, Volume I: Estua-rine Physics. CRC Press, Boca Raton, FL. 1988. p 133-148, 5 fig, 44 ref.

Descriptors: *Estuaries, *Model studies, *Water currents, *Tidal hydraulics, *Residual currents, Circulation patterns.

Methods for modeling the tidally induced residual currents are summarized and typical circulation patterns and their associated dynamics for the computed residual currents in various coastal waters are described. A fully three-dimensional tidal model is expensive to run and generally requires a large computer; thus all detailed studies of the tidally-induced residual current involve some simplification. Residual currents computed from the following models are summarized: narrow estuarine models where cross-channel velocity is neglected: models for submarine hanks and near arine models where cross-channel velocity is ne-glected; models for submarine banks and near straight coasts where along-isobath variations are neglected; two-dimensional depth-averaged tidal models where depth-dependent features are ne-glected; and a two-level tidal model where the vertical water column is crudely approximated by two constant thicknesses. Detailed studies of fully three-dimensional tidally-induced residual currents are not yet available. (See also W89-02682) (See also W89-02682) (Davis-PTT) W89-02690

EULERIAN AND LAGRANGIAN MODELING OF ESTUARINE HYDRODYNAMICS,

Geological Survey, Menlo Park, CA. Water Resources Div.

IN: Hydrodynamics of Estuaries, Volume I: Estuarine Physics. CRC Press, Boca Raton, FL. 1988. p 149-159, 6 fig, 27 ref.

Descriptors: *Model studies, *Eulerian modeling, *Lagrangian modeling, *Estuaries, *Hydrodyna-mics, San Francisco Bay, California, Water cur-rents, Mathematical modeling.

Modeling of estuarine hydrodynamics is often carried out in an Eulerian reference frame. The transport processes which take place in tidal estuaries are convection dominated and can be better represented by Lagrangian treatments. The Eulerian approach treats all dependent variables as functions of fixed coordinates and time. A Lagrangian treatment considers the dependent variables as functions of time and their initial positions. Several examples are given in the context of using combined Eulerian and Lagrangian modeling techniques in studies of circulation in San Francisco Bay, California. If one adopts the Lagrangian conniques in studies of circulation in San Francisco Bay, California. If one adopts the Lagrangian concept; i.e., by following the movement of the water parcel trajectory, it is not surprising to find that the net Lagrangian water parcel displacement depends on the time (tidal current phase) when the water parcel is labeled and released. Because the water parcel is labeled and released. Because the water parcel is labeled and released. Because the state parcel is released at different phases of the tides, they inscribe different trajectories in space. Since the net displacements are functions of the bathymetry enclosed within the trajectories, there is not any reason to expect that the net displacements should be identical. Because the Eulerian computational techniques and field data collection techniques are well established, the vast majority of field data were collected in the Eulerian sense and most of the mathematical models for tidal circulation in estuaries have been developed, california in estauries have been developed, california fraging the state of the control of the state of the control of the state of the control of the mathematical models for tidal circulation in estuaries have been developed, california fraging the control of the state of the control of th and most of the mathematical models for tidal circulation in estuaries have been developed, calibrated, and verified using an Eulerian point of view. Once such an Eulerian model becomes available, further investigations of the Lagrangian properties of flows in estuaries can be carried out numerically based on results from an Eulerian numerical model. The combination seems to be an optimal compromise in estuarine hydrodynamic modeling. (See also W89-02682) (Davis-PTT) W89-02691

HYDRODYNAMICS OF OLUME II: ESTUARINE CASE STUDIES. South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research. CRC Press, Boca Raton, FL. 1988. 125p. Edited by Bjorn Kjerfve.

Descriptors: *Estuaries, *Hydrodynamics, Case studies, Water circulation, Mixing.

This book is one of two volumes which attempt to summarize many of the prevalent concepts and approaches in the investigation into hydrodynamics and physical processes of estuaries. This

Estuaries—Group 2L

second volume gathers together in one place physical case studies of several important estuaries. Without attempting to give equal play to all areas of the world, the selection of both authors and estuarine case studies strives to be international in scope. These books should prove useful to oceanscope. These books should prove useful to ocean-ography students, research workers in the field, and to persons charged with the management of estuarine resources. (See W89-02693 thru W89-02701) (See also W89-02682) (Davis-PTT) W89-02692

OCEANOGRAPHY OF CHESAPEAKE BAY, State Univ. of New York at Stony Brook. Marine Sciences Research Center. H. H. Carter, and D. W. Pritchard. IN: Hydrodynamics of Estuaries, Volume II: Estu-arine Case Studies. CRC Press, Boca Raton, FL. 1988. p 1-16, 9 fig, 1 tab, 25 ref.

Descriptors: *Oceanography, *Tides, *Estuaries, *Tidal currents, *Chesapeake Bay, Severn River, Kelvin wave, Virginia, Salinity, Susquehanna River, Temperature.

The residual circulation and forcing mechanisms, the tides and tidal currents, and the salinity and temperature distributions of the Chesapeake Bay are summarized. Chesapeake Bay is able to hold a complete semidiurnal tidal wave at all times. In the Bay below the Severn River, the tide has the characteristics of a Kelvin wave, with a slightly larger range on the eastern side than on the western side and with maximum flood and maximum ebb occurring at nearly the same time as high water and low water, respectively. North of the Severn, the characteristics are intermediate be-Severn, the characteristics are intermediate between those of a pure progressive wave and those of a standing wave, but becoming asymptotic to the characteristics of a standing wave as one approaches the head of the Bay. The mean tidal range decreases from about 3.0 ft at the entrance to a minimum of about 1.0 ft at Annapolis, then rises a minimum of about 1.0 ft at Annapolis, then rises to 2.3 ft at the head. The maximum range in the system is 3.9 ft at Walkinston, Virginia on the Mattiponi River. Average tidal current amplitudes in the cross section at the mouth of the Bay vary from 1.25 knots to 2.00 knots. Residual currents are from 1.25 knots to 2.00 knots. Residual currents are caused by the seaward sloping sea surface and the upstream or riverward longitudinal density gradient, and by the lateral and vertical components and their variations in the longitudinal component. Bay salinity varies more or less regularly along the length of the Bay, from that of nearly full seawater at the mouth to that of the inflowing Susquehanna River water at the head of the Bay. Man has had little effect on the salinity distribution in the Bay or its tributaries. There are marked advanced to the proposal of the salinity distribution in the Bay or the salinity distribution in the salinity distributi ittle erfect on the sammty distribution in the Bay or its tributaries. There are marked natural temporal and spatial variations of water temperature in the Chesapeake Bay system. The distribution of temperature is affected by man; significant temperature effects have not been demonstrated for the open Bay as yet but several tributary estuaries have had Bay as yet out several inotest yet studies have had their temperature distribution measurably altered. (See also W89-02682) (Davis-PTT) W89-02693

PUGET SOUND: A FJORD SYSTEM HOMOG-ENIZED WITH WATER RECYCLED OVER SILLS BY TIDAL MIXING, Evans-Hamilton, Inc., Seattle, WA. C. C. Ebbesmeyer, J. Q. Word, and C. A. Barnes. IN: Hydrodynamics of Estuaries, Volume II: Estu-arine Case Studies. CRC Press, Boca Raton, FL. 1988. p 17-29, 7 fig, 2 tab, 34 ref.

Descriptors: *Tidal currents, *Estuaries, *Mixing, *Puget Sound, *Fjords, Discharge measurement.

Puget Sound, in Washington State, is a system of fjord basins connected by constrictions in which there are strong tidal currents. The turbulence of these tidal currents causes water and other substances to be vigorously recycled among the basins before escaping the system after periods lasting as long as several years. There are substantial vari-ations of physical and biological characteristics at intervals of physical and olological characteristics in intervals of days, seasons, and years. Some of the processes which control the variability at the shorter intervals have been investigated, but those governing the longer scales remain poorly known.

The water within Puget Sound is a mixture of approximately 90 percent Pacific Ocean water and 10 percent freshwater. This system has a behavior which is distinct from that of single basins because which is distinct from that of single basins because of recirculating water masses. Because man's individual discharges are recycled throughout Puget Sound, the impact of these activities will have to be managed from a system point of view rather than according to individual discharges. (See also W89-02682) (Davis-PTT) W89-02681

LAGUNA MADRE OF TEXAS: HYDROG-RAPHY OF A HYPERSALINE LAGOON, Harbor Branch Oceanographic Institution, Inc.,

Fort Pierce, FL. N. P. Smith.

IN: Hydrodynamics of Estuaries, Volume II: Estuarine Case adies. CRC Press, Boca Raton, FL. 1988. p 31-40, 4 fig, 23 ref.

Descriptors: *Laguma Madre, *Hypersalinity, *Hydrography, *Estuaries, *Salinity, *Texas, *Lagoons, Gulf of Mexico.

Salinity observations from a 26-month period of time in the mid 1960s are used to characterize the mean hypersaline state of northern Laguna Madre, mean hypersatine state of northern Laguna Madre, Texas, and seasonal departures from the mean. Both the mean salinity and its standard deviation increase in the interior of the lagoon, away from the buffering effects of exchanges with adjacent, brackish water bays. A three-dimensional mesh perspective plot suggests quasiperiodic variations in salinity over time scales of about 4 to 5 months. in sainity over time scales of about 4 to 5 months occurring throughout the lagoon, but especially in the interior. Spectral analysis of lagoon and coastal water level records from early 1974 reveals statistically significant coherence levels at semidiurnal and diurnal tidal periodicities and over time scales in excess of about 2 days. Energy density spectra in excess of about 2 days. Energy density spectra show that tidal period water level variations are greatly damped in the lagoon. Low-frequency meteorological foreing is of primary importance in driving lagoon-shelf exchanges, moderating salinity extremes and maintaining water quality. A 20-month coastal water level record from the mid 1970s is used in a simple, one-dimensional numerical model to quantify the transport of Gulf of 1970s is used in a simple, one-dimensional numerical model to quantify the transport of Gulf of Mexico water into the lagoon. Calculations suggest an intermittent renewal of water primarily over fortnightly and seasonal time scales. (See also W89-02682) (Davis-PTT)

MOBILE BAY ESTUARY: STRATIFICATION, OXYGEN DEPLETION, AND JUBILEES, Alabama Marine Resources Lab., Dauphin Island. W. W. Schroeder, and W. J. Wiseman. IN: Hydrodynamics of Estuaries, Volume II: Estuarine Case Studies. CRC Press, Boca Raton, FL. 1988. p 41-52, 7 fig, 21 ref.

Descriptors: *Estuarine environment, *Stratifica-tion, *Estuaries, *Benthos, *Mobile Bay, *Oxygen depletion, *Jubilees, Migration, Hypoxia.

Jubilees, mass migrations of estuarine organisms to the shores of Mobile Bay, have been presumed to be induced by hypoxic bottom waters. Interactions of the bay's geomorphology, water column structure, circulation, biological activity, and man-made modifications result in oxygen depletion zones, These, in turn, elicit movement response from certain estuarine biota. During summer months, strong haline stratification isolates the bottom waters of Mobile Bay from direct airses interacwaters of Mobile Bay from direct air-sea interac-tion. High temperatures increase metabolic rates tion. High temperatures increase metabolic rates and benthic consumption reduces near-bottom dissolved oxygen content of the water column to values that are stressful to the biota. This hypoxic water is advected by tides and wind-driven baroclinic motions. This movement appears to be responsible for the jubilee phenomenon in the Bay. Large areas of the Bay are affected by hypoxic conditions. Strong wind can rapidly dissipate these conditions. Hypoxia quickly redevelops following reestablishment of the stratification after a wind event. Hypoxic conditions are not found in winter. Presumably, this is because wind mixing is more frequent than in summer and lower temperatures

result in reduced benthic oxygen consumption rates. Oxygen depletion has been reported during periods of spring river flooding episodes, but no jubile type activities have been observed during these events. (See also W89-02682) (Davis-PTT)

CIRCULATION ANOMALIES IN TROPICAL AUSTRALIAN ESTUARIES.

Australian Inst. of Marine Sciences, Townsville.
Dept. of Physical Oceanography.

IN: Hydrodynamics of Estuaries, Volume II: Estuarine Case Studies. CRC Press, Boca Raton, FL. 1988. p 53-59, 4 fig, 4 ref.

Descriptors: *Water circulation, *Tropical regions, *Estuaries, *Saline-freshwater interfaces, *Australia, Salinity, Temperature, Evaporation, Circula-

tropical estuaries of Northern Australia are characterized by large seasonal fluctuations in the freshwater discharge. The estuaries respond to the seasonal fluctuations. The importance of evaporation and evapotranspiration in driving the baroclinic estuarine circulation in the following rivers was studied: the Alligator River-Van Diemen Gulf system, the Norman River, the Ducie-Wenlock River, the Escape River, and Coral Creek. The waters of the South Alligator River were well-mixed vertically. Salinity increased with distance downstream. There was evidence of warm Gulf water of greater salinity intruding up-river near the bottom. Both salinity and temperature decreased regularly across the Van Diemen Gulf toward the Arafura Sea which was strongly temperature stratified. There is no direct mixing and exchange of water between the estuary and the Arafura Sea. The exchange can only occur through the salinity maximum zone. Evaporation is presumed to be the ne exchange can only occur through the saining maximum zone. Evaporation is presumed to be the reason for this unusual estuarine behavior. In the dry season, the South Alligator River Waters are essentially trapped in the estuary. In the Norman River, free water evaporation creates a salinity maximum zone. Evaporation in the adjoining salt pans results in occasional additions of salt to the pans results in occasional adultions of sale to the setuary, thereby reinforcing the salinity maximum zone. A salinity maximum zone was also found in the other tropical estuaries. The salinity maximum zone was located in the estuary just upstream of the river mouth. Hence, a inverse estuaring in appears to be present in the dry season near the river mouth in all the Australian tropical estuaries that have been studied. (See also W89-02682) (Davis-PTT) 89-02691

PHYSICAL OCEANOGRAPHY OF THE ST.

LAWRENCE ESTUARY,
Quebec Univ., Rimouski. Dept. of Oceanography.
M. I. El-Sabh.

M. I. El-Saon. IN: Hydrodynamics of Estuaries, Volume II: Estuarine Case Studies. CRC Press, Boca Raton, FL. 1988. p 61-78, 9 fig., 1 tab, 66 ref. Natural Sciences and Engineering Research of Canada Grant

Descriptors: *Oceanography, *Estuaries, *Mixing, Circulation, *St. Lawrence, Salinity, Water currents, Tides.

The circulation dynamics and distribution of properties of the St. Lawrence estuary are reviewed. All three types of estuarine mixing exist in the St. Lawrence estuary: the well-mixed, at the head of the estuary; the moderately-mixed, in the section below the head; and the stratified in the lower part. Both advection and diffusion contribute importantly to the upstream salt flux in the upper part while advective processes account for more than 99 percent of upstream salt transfer in the lower part. Because of the presence of internal waves, fronts, and extensive tidal mixing, vertical oscillations of up to 80 m of the intermediate cold layer are common in the area near the Saguenay entrance. The lower estuary is characterized by two circulation modes: the first is a series of gyres with alternating rotational senses along the estuary accompanied with transverse currents and fronts be-

Field 2-WATER CYCLE

Group 2L—Estuaries

tween any two gyres, and the second mode shows the estuary divided longitudinally into two halves, the southern one characterized by cold, more saline, and denser waters compared to the northern part. The combined actions of the neap-spring tidal cycle, meteorological forcing, freshwater dis-charge, and topography are believed to be the cause for such variability. (See also W89-02682) cause for such (Davis-PTT) W89-02698

OCEANOGRAPHIC CHARACTERISTICS OF THE SEINE ESTUARY, Centre d'Oceanologie de Marseille (France). J. C. Salomon.

J. C. Salomon. IN: Hydrodynamics of Estuaries, Volume II: Estuarine Case Studies. CRC Press, Boca Raton, FL. 1988. p 79-88, 7 fig, 8 ref.

Descriptors: *Oceanography, *Estuaries, *Tides, *Seine River, Tidal range, Tidal cycle, Saline water intrusion.

The Seine River is an example of macrotidal estu-ary with tidal range and depths of the same order of magnitude. The amplitude and specific shape of the tidal curve combine with relatively low river inputs to give the estuary essentially marine dy-namic characteristics. Through artificial modifications that reduce the estuary to a a simple channel, man has restricted the intrusion of saltwater from man has restricted the intrusion of saltwater from the marine environment, thus geographically separating dynamic and densimetric processes. This estuary is far from being in an equilibrium state, and sediments escaping from the channel are presently accumulating in the lateral parts of the mouth. The result is the beginning of a new estuary in the eastern bay. An interesting perspective will be to see how nature and man's actions are going to combine and mold this new Seine estuary. (See also W89-02682) (Davis-PTT) W89-02692 W89-02699

CONSEQUENCES OF DREDGING,

Virginia Inst. of Marine Science, Gloucester Point. M. M. Nichols.

IN: Hydrodynamics of Estuaries, Volume II: Estuarine Case Studies. CRC Press, Boca Raton, FL. 1988. p 89-99, 9 fig, 23 ref.

Descriptors: *Environmental impact, *Estuaries, *Dredging, *Sedimentation, *Hydrodynamics, Tidal amplitude, Delaware Estuary, Lune Estuary, Seine Estuary, Saline water intrusion.

The ever increasing demand for creating new channels for shipping, boating, and naval defense has made it necessary to gain a more complete understanding of the consequences of dredging on estuarine hydrodynamics and sedimentation. Dredging increases the tidal range. When an estuary is dredged to depths greater than those dictations. ed by the equilibrium regime, sediments accumulate to reestablish an equilibrium depth in accord with the tidal hydraulics. When dredging removes with the tidal hydraulics. When dredging removes shoals and rock, the effects of friction are reduced so that convergence exceeds friction. Consequently, tidal amplitude increases toward the estuary head. Removal of a shoal or bank by dredging can shift the position of the nodal point. Consequently, tidal amplitude can be reduced seaward of the shoal but increased landward of the shoal but increased landward of the bank. Wave energy that is not reflected can pass farther landward of the shoal and transform into an asymmetrical progressive wave. When an expert is in lease. cal progressive wave. When an estuary is in long-term equilibrium, erosion balances sedimentation, but when dredging increases the water depth or width greater than that dictated by equilibrium, sedimentation sets in. A small change n geometry of an estuary can produce a large effect. The of an estuary can produce a large effect. Ince
effects of dredging and diking vary widely in different types of estuaries. Case histories of the Delaware Estuary, the Lune Estuary, U.K., and the
Seine Estuary, France, are presented to demonstrate differences. As dredging removes entrance shoals or bars, and as deepening increases the volume of the channel, the ability of river flow to hold back saltwater is reduced. Saltwater can penetrate farther landward than its normal position. As channels are dredged deeper, the potential for entrapment of sediment is increased. Great sedi-

mentation necessitates more dredging and therefore, dredging is self-perpetuating. (See also W89-02682) (Davis-PTT) W89-02700

DJINNANG II: A FACILITY TO STUDY MIXING IN STRATIFIED WATERS, Western Australia Univ., Nedlands. Dept. of Civil

Engineering.
For primary bibliographic entry see Field 7B.
W89-02701

CLAM SHELL DREDGING IN LAKES PONT-CHARTRAIN AND MAUREPAS, LOUISIANA, Army Engineer District, New Orleans, LA. For primary bibliographic entry see Field 6G. W89-02715

BIOLOGICAL SURVEYS OF ESTUARIES AND

For primary bibliographic entry see Field 7B. W89-02759

PLANNING BIOLOGICAL SURVEYS, Field Studies Council, Shrewsbury (England). For primary bibliographic entry see Field 7B. W89-02760

REMOTE SENSING,

Imperial Coll. of Science and Technology, London (England). Dept. of Pure and Applied Biology. For primary bibliographic entry see Field 7B. W89-02761

SALT MARSHES, Imperial Coll. of Science and Technology, London (England). Dept. of Pure and Applied Biology. For primary bibliographic entry see Field 7B. W89-02762

FLORA AND MACROFAUNA OF INTERTI-DAL SEDIMENTS, Rijksinstituut voor Natuurbeheer, Texel (Nether-

lands). W I Wolff

In: Biological Surveys of Estuaries and Coasts. Cambridge University Press, New York. 1987. p 81-105, 9 fig, 38 ref.

Descriptors: *Intertidal areas, *Littoral environ-ment, *Marine sediments, *Sampling, *Surveys, Beaches, Flora, Macroinvertebrates, Macrofauna, Estuarine environment, Mapping, Coasts, Sea-

Intertidal sediments form beaches and tidal flats, which usually are gently sloping areas without erect vegetation. Sand and mud flats are the most extensive intertidal habitat in the majority of the north-west European countries. In mapping logical features of beaches and tidal flats, logical features of beaches and tidal flats, some features such as mussel beds, and seagrass beds may be mapped from aerial photographs, but other features have to be mapped in the field. While qualitative biological surveys essentially record the presence or absence of species, the major aim of a quantitative survey is to estimate the numbers of one or more species or another parameter per unit area from a series of samples. Sampling strategies for the various flora and macrofauna are discussed, as separation and counting of microalgae and pig-ment extraction. The problems of position fixing of the sampling station and transport of people, equip-ment and samples on tidal flats are also detailed. (See also W89-02759) (VerNooy-PTT) W89-02763

MACROFAUNA OF SUBTIDAL SEDIMENTS USING REMOTE SAMPLING, BP Petroleum Development Ltd., Aberdeen (Scot-

J. P. Hartley, and B. Dicks.
IN: Biological Surveys of Estuaries and Coasts.
Cambridge University Press, New York. 1987. p
106-130, 5 fig. 60 ref.

Descriptors: *Sampling, *Marine sediments, *Benthic fauna, *Sampling, *Surveys, *Neritic environment. Distribution patterns, Environmental impact statement, Data collections, Coasts,

This chapter is concerned with strategies and methods for studying the abundance and distribution of benthic organisms in soft sediment, to assess both natural distribution and the effects of human influences. Emphasis has been placed on the assessment of rellution democracy in view of increases. influences. Emphasis has been placed on the assessment of pollution damage in view of increasing concern over the effects of discharges to the marine environment. Sampling and laboratory methods discussed here are limited to techniques that work particularly well or have not been previously reported in detail. The Sampling strategies for the macro-infauna, along with examples illustrating approaches used in various coastal waters, are discussed. Some techniques and pieces of equipment that have been found useful in sampling boats and equipment used in sample location and relocation, qualitative samplers (dredges and trawls), quantitative samplers (grabs and corers), and remote sensing techniques. (See also W89-02759) (VerNooy-PTT) W89-02764

PROCESSING SEDIMENT MACROFAUNA

SAMPLES, BP Petroleum Development Ltd., Aberdeen (Scotland).

For primary bibliographic entry see Field 7B. W89-02765

MEIOFAUNA, Institute for Soil Fertility, Haren (Netherlands). L. A. Bouwman. In: Biological Surveys of Estuaries and Coasts. Cambridge University Press, New York. 1987. p 140-156, 2 tab, 43 ref.

Descriptors: *Meiofauna, *Fauna, *Surveys, *Benthic fauna, *Sampling, Biological samples, Nematodes, Crustaceans, Estuaries, Coasts, Plan-

The meiofauna comprises animals intermediate in size between microfaunal organisms such as ciliates, amoebas, and foraminiferans, and macrofaunal ates, amoebas, and foraminiferans, and macrofaunal organisms such as gastropods, bivalves, and polychaetes. It is usually defined as benthic metazoa that can pass through a sieve with a mesh size of 0.5 or 1.0 mm. The meiofauna consists mainly of various types of microscopic worms and crustaceans. Aims of surveys concerning meiofauna can be ranged under the same categories as biological surveys in general; those of particular relevance to meiofauna are detailed. In principle, when designing a sampling program for meiofauna one bas meiotauna are detailed. In principle, when designing a sampling program for meiofauna one has to deal with the same problems as designing a macrofauna survey; however, the scale is centimeters instead of meters. Common sampling methods and sample processing for meiofauna are discussed along with methods of sample processing and data processing and interpretation. A framework of opprocessing and interpretation. A framework of op-tions is presented for meiofauna surveys of increa-ing completeness, ranging from an occasional survey of one species to frequent samplings of the entire meiofauna during several years. (See also W89-02759) (VerNooy-PTT) W89-02766

INTERTIDAL ROCK, Field Studies Council, Shrewsbury (England). J. M. Baker, and J. H. Crothers. In: Biological Surveys of Estuaries and Coasts. Cambridge University Press, New York. 1987. p. 157-197, 9 fig, 2 tab, 78 ref, 2 append.

Descriptors: *Intertidal areas, *Littoral zone, *Rocks, *Surveys, *Coasts, *Seashores, Project planning, Planning, Sampling, Wave action, Aquatic habitatis.

Rocky shores, with their obvious zonation of plants and animals, are attractive for both research and educational projects. Special planning consid-

Estuaries—Group 2L

erations for conducting a biological survey are detailed, such as time available on the shore, delimiting the working area, markers and reference points, and trampling the area are discussed. The effect of wave action is an important factor affecting the shore communities and is also detailed here. When other physical factors such as slope, rock was crock pools become extended the control of the physical factors such as slope, rock was crock pools become exwhen other physical factors such as stope, rock type, crevices, stones or rock pools become extreme, they may have an overriding influence on shore ecology. Abundance scales, often used for extensive surveys or transect surveys, are discussed, as well as extensive descriptive surveys cused, as well as extensive descriptive surveys, (primary surveys and detailed extensive surveys). Conclusions concerning survey techniques appropriate for different survey objectives are listed in a table. Methods need to be developed for surveying table. Methods need to be developed for surveying stone/boulder communities. For example, it might be feasible to take several samples of stones of a particular size and look at the organisms associated with them. Pitfall traps could possibly be used to catch mobile organisms. (See also W89-02759) (VerNooy-PTT)

W89-02767

SUBTIDAL ROCK AND SHALLOW SEDI-MENTS USING DIVING, Field Studies Council, Pembroke (Wales). Oil Pol-lution Research Unit. For primary bibliographic entry see Field 7B. W89-02768

BACTERIA AND FUNGI, University Coll. of North Wales, Menai Bridge. School of Ocean Sciences. For primary bibliographic entry see Field 7B. W89-02769

PLANKTON.

University Coll. of North Wales, Menai Bridge. School of Ocean Sciences.

P. B. 1ett. IN: Biological Surveys of Estuaries and Coasts. Cambridge University Press, New York. 1987. p 280-341, 10 fig, 2 tab, 124 ref, 3 append.

*Surveys, *Samping,
Lon *Zooplankton, Descriptors: *Plankton, *Surveys, *Sampling, *Hydrography, *Phytoplankon, *Zooplankton, Planning, Aquatic habitats, Biological samples, Es-tuarine environment, Coasts, Seashores, Project

Plankton cannot be investigated in the same way as the attached benthos or the active swimmers of the the attached bentinos of the active swimmers of the nekton, since the sea itself is constantly in motion. Plankton surveys are discussed, with suggestion of efficient ways to investigate and explain the amount, distribution, and general composition of plankton in coastal seas and estuaries. Each plankplankton in coastal seas and estuaries. Each plankton investigation requires a sampling program
adapted both to the specific aims of that investigation and to local conditions. Plankton must be
investigated in relation to hydrography. It is also
important to choose spatial and temporal sampling
patterns appropriate to the hypothesis under investigation and the relevant physical and biological
time-scales. Finally, the variables to be measured
must be selected in relation to the aims of the
survey and the efficiency of their measurement. If
appropriate, physical and chemical techniques for
most measurements should be used, employing appropriate, physical and chemical techniques for most measurements should be used, employing time-consuming biological analysis only to cali-brate the simpler measurements or to indicate the composition of biomass. (See also W89-02759) (VerNooy-PTT) W89-02770

FISH (SURVEY OF), Marine Biological Association of the United King-dom, Plymouth (England). For primary bibliographic entry see Field 7B. W89-02771

BIRDS.

Royal Society for the Protection of Birds, Shore-ham-by-Sea (England). A. J. Prater, and C. S. Lloyd. IN: Biological Surveys of Estuaries and Coasts. Cambridge University Press, New York. 1987. p

374-403, 6 fig. 1 tab, 61 ref, append.

Descriptors: *Birds, *Water birds, *Waterfowl, *Surveys, *Estuaries, *Estuarine environment, *Coasts, *Seashores, Project planning, Planning, Animal populations, Europe.

With a few exceptions, birds are relatively easy to census because they are large, readily identified without being collected, and easy to see. Nevertheless, surveys do need careful planning. The greatest problem concerns the birds' mobility. Numbers present in a coastal area may depend on many different factors and each group of species must be assessed separatelly. The main variables are related to annual, seasonal, tidal, and diurnal rhythms, which are discussed here. Along with methods, the results of many European surveys are summarized. results of many European surveys are summarized.

Methods for determining the numbers and distribution of non-breeding coastal birds in estuaries and along inshore waters are included. Also detailed along inshore waters are included. Also detailed are methods for surveying the numbers of cliffnesting seabirds and terns. One of the most practicable methods of obtaining some index of mortality in birds in estuaries and at sea is by beached-bird
surveys. The methods, frequency, biases and results of routine beached-bird surveys are discussed.
(See also W89-02759) (VerNooy-PTT)
W89-02772

FORMULAS FOR VELOCITY, SEDIMENT CONCENTRATION AND SUSPENDED SEDI-MENT FLUX FOR STEADY UNI-DIRECTION-AL PRESSURE-DRIVEN FLOW,

National Oceanic and Atmospheric Administra-tion, Seattle, WA. Pacific Marine Environmental

For primary bibliographic entry see Field 2J. W89-02779

NEW HAVEN HARBOR NUMERICAL MODEL

NEW HAVEN HARBOR NUMERICAL MODEL STUDY, Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab. For primary bibliographic entry see Field 6G. W89-02874

I-664 BRIDGE-TUNNEL STUDY, VIRGINIA SEDIMENTATION AND CIRCULATION IN-

Vicksburg, MS. Hydraulics Lab. For primary bibliographic entry see Field 4C. W89-02875

CAUSES OF WETLAND LOSS IN THE COAST-AL CENTRAL GULF OF MEXICO, VOLUME 2: TECHNICAL NARRATIVE.

Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 4C.
W89-02878

CAUSES OF WETLAND LOSS IN THE COAST-AL CENTRAL GULF OF MEXICO, VOLUME 3.

Louisiana State Univ., Baton Rouge. Coastal Ecol-For primary bibliographic entry see Field 4C.

ABOVE- AND BELOW-GROUND MACRO-PHYTE PRODUCTION IN SCIRPUS TIDAL MARSHES OF THE ST. LAWRENCE ESTU-

ARY, QUEBEC, Laval Univ., Quebec. Dept. de Biologie. J. F. Giroux, and J. Bedard.

J. F. Giroux, and J. Bedard. Canadian Journal of Botany CJBOAW, Vol. 66, No. 5, p 955-962, May 1988. 3 fig. 6 tab, 40 ref. Supply and Services Canada Contract OSD82-00099 with the Canadian Wildlife Service.

Descriptors: *Estuaries, *Tidal marshes, *Aquatic productivity, *Macrophytes, *Bulrushes, *St. Lawrence River, *Quebec, Standing crops, Primary productivity, Seasonal variation, Biomass, Life history studies, Wild rice, Arrowheads.

Standing crops as well as primary production of Standing crops as wen as primary production or several macrophytes were estimated in Scirpus marshes along the south shore of the St. Lawrence River estuary. Aboveground standing crop was measured by clipping vegetation, while below-ground standing crop was estimated by soil coring. Seasonal variation of live and dead standing crops Seasonal variation of live and dead standing crops was first determined for different plant species. The root-shoot mass ratio was then examined and related to the life history of each species. Perennials such as the rushes Scirpus americanus, S. torreyi, Eleocharis, and Juncus had ratios greater than 1, whereas the annual Zizania (wild rice) had a ratio of 0.1. Sagittaria (arrowhead), which exhibits both perennial and annual behavior, was intermediate, with values of 0.6-0.8. Total aboveground production varied from 74 to 6.73 ceach for the contraction of t mediate, with values of 0.6-0.8. Total aboveground production varied from 74 to 627 g ash-free dry mass/square m/yr among different plant communities, whereas belowground production was lower, with estimates varying between 38 and 244 g/sq m/yr. Production was lower along the St. Lawrence estuary than in other types of marshes located farther south. (Shidler-PTT)

CHANGE IN DISTRIBUTION PATTERNS OF PHOTOSYNTHETICALLY INCORPORATED C DURING PHYTOPLANKTON BLOOM IN CONTROLLED EXPERIMENTAL ECOSYS-

Nagoya Univ. (Japan). Water Research Inst. T. Hama, N. Handa, M. Takahashi, F. Whitney, and C. S. Wong.

Journal of Experimental Marine Biology and Ecology JEMBAM, Vol 120, No. 1, p 39-56, August 23, 1988. 3 fig, 5 tab, 46 ref.

Descriptors: *Coastal waters, *Phytoplankton, *Photosynthesis, *Nutrients, *Carbon, In situ tests, Canada, Nitrates, Silicates, Phosphates, Diatoms, Flagellates, Isotope studies, Proteins, Carbohy-

A study was conducted in an experimental system (a column of water captured in a polyethylene bag of about 2.5 m in diameter and 16 m in length) in Patricia Bay, Saanich Inlet, British Columbia, Canada. Nutrients (nitrate-1800 mg at; silicate-3000 mg at; and phosphate-180 mg at) were added immediately after capture. Sampling took place over 23 days. Before analysis, samples were incubated with 13C-labeled sodium bicarbonate. Rapid increases of the abstronaktors recognists. bated with 13C-labeled sodium bicarbonate. Rapid increase of the phytoplankton population dominated by Chaetocerous spp. and small nanoflagellates was observed after the addition of nutrients. Protein was the most abundant product during the rapid increase in nutrient-rich conditions, and accounted for >50% of total organic C production in the surface zone, whereas the percentage share of carbohydrate increased as nitrate plus nitrite was exhausted. The gas-chromatography/mass-spectrometry analysis of 13C-labeled photosynthetic products revealed that high production of carbohydrate under nutrient-depleted conditions was ic products revealed that high production of carbo-hydrate under nutrient-depleted conditions was mainly due to high production of glucose (glucan). These results showed that photosynthetic products were greatly affected by availability of inorganic N, which agreed with the trend of the composi-tional change in phytoplankton cells in culture. Specific production rates of carbohydrate and pro-Specine production rates of carbonyariae and pro-tein indicated that 'balanced' production occurred during the nutrient-rich conditions, but an exhaus-tion of the inorganic N resulted in upsetting 'bal-anced' production. (Shidler-PTT) W89-03059

TEMPORAL RELATIONSHIP OF VIBRIO PARAHAEMOLYTICUS IN PATIENTS AND THE ENVIRONMENT, Shaughnessy Hospital, Vancouver (British Columbia). Div. of Microbiology. For primary bibliographic entry see Field 5B. W89-03064

GLACIO-EUSTATIC SEA-LEVEL CONTROL ON RED SEA SALINITY, South Carolina Univ., Columbia. Dept. of Geolog-

Field 2-WATER CYCLE

Group 2L—Estuaries

Nature NATUAS, Vol. 334, No. 18, p 601-604, August 1988. 1 fig, 1 tab, 43 ref.

Descriptors: *Paleohydrology, *Paleoclimatology, *Red Sea, *Salinity, *Seawater, *Glaciation, *Gla-ciohydrology, *Sea level, Foraminifera, Minerals, Isotope studies, Oxygen isotopes, Sedimentation.

Previous studies of the Red Sea demonstrated that glacial surface- and bottom-water salinities in the basin were significantly higher than at present. The very low abundance of planktonic foraminifera, the so-called 'aplanktonic zone', during the last glacial indicates that surface-water conditions approached or exceeded the tolerance limits of this plankton group. Glacial sediments are also characterized by high concentrations of magnesian calcite, dolomite, inorganically precipitated aragonite and benthic foraminifera typical of hypersaline environments. Additional evidence from oxygen isotope records of planktonic and benthic foraminifera, as well as pteropods, demonstrate that glacialera, as well as pteropods, demonstrate that glacial-interglacial contrasts in the Red Sea have an ampliinterglacial contrasts in the Red Sea have an amplitude much larger than typically observed in open ocean records. Here both oxygen isotope data and a 'frictional overmixing' model was used to estimate the impact of the most recent (18,000 yr BP) Pleistocene glacio-eustatic sea-level lowering on Red Sea salinity. During the last glacial maximum, surface salinities in the central Red Sea were more than 10.0 parts per thousand higher than at present. Deep-water salinities were also higher during the last glaciation and remained unusually high through deglaciation. The combination of very high bottom salinities and the onset of pluvial conditions during deglaciation in the Red Sea region prevented ventilation of Red Sea bottom waters and resulted in the accumulation of organicrich sediments. (Author's abstract) rich sediments. (Author's abstract) W89-03119

ROLE OF ICE IN THE MORPHO-SEDIMEN-TOLOGIC REGIME OF A SHORELINE IN THE MIDDLE SAINT LAWRENCE ESTUARY (LE ROLE DES GLACES DANS LE REGIME MORPHO-SEDIMENTOLOGIQUE D'UN ESTRAN DE L'ESTUAIRE MOYEN DU SAINT-

Laval Univ., Quebec. Dept. of Civil Engineering. For primary bibliographic entry see Field 2J. W89-03133

COASTAL LAGOONS OF EAST ANGLIA, U.K.,

Cambridge Univ. (England). Dept. of Zoology. R. S. K. Barnes. Journal of Coastal Research, Vol. 3, No. 4, p 417-427, Autumn 1987. 8 fig, 2 tab, 22 ref.

Descriptors: *Lagoons, *Coastal geomorphology, *Coastal marshes, *Saline water barriers, *England, Ridging, Aquatic life, Aquatic habitats.

Twenty-six remaining coastal lagoons in East Anglia, U.K., fall into six distinct categories on the basis of their origin, physiography, hydrography, and sedimentology, all six either created or heavily influenced by man: (1) pits or other excavations within shingle formations into which water percolates; (2) depressions remaining in reclaimed salt marshes into which springs discharge water retained within adjacent sand dunes; (3) shallow pools floored by clay and filled by water issuing to landwards from out of longshore shingle ridges; (4) streams or small rivers ponded back by low-lying barrier beaches; (5) short-circuited former estuaries; and (6) relict bodies of brackish water. From a world viewpoint, all but category (4) are aberrant in having neither any freshwater inflow (other than rainfall) nor any direct influx of seawater; in common with other northern Atlantic lagoons, all common with other northern Atlantic lagoons, all are further atypical in being confined behind barriers composed largely of shingle. Their rather limited macrofaunas and macrofloras, however, are characteristically lagoonal, although there is wide cnaracteristically lagoonal, atthough there is wide variation in species from lagoon to lagoon, even between geographically adjacent systems. The precise species found in any given lagoon appear largely to be the result of stochiastic processes, there being no correlation of biotas with physiographic category or environmental type, with the partial exception of lagoonal salinity. (Author's abstract)

SEDIMENT TRANSPORT PREDICTION IN A TIDAL INLET USING A NUMERICAL MODEL: APPLICATION TO STONY BROOK HARBOR, LONG ISLAND, NEW YORK, USA, State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 2J.
W89-03185

CHANGE IN SEDIMENTATION FOLLOWING RIVER DIVERSION IN THE EASTMAIN ES-TUARY (JAMES BAY), CANADA, McGill Univ., Montreal (Quebec). Inst. of Oceanography.

For primary bibliographic entry see Field 2J. W89-03186

SEDIMENT TRANSPORT FROM DELAWARE BAY TO THE NEW JERSEY INNER SHELF, Rider Coll., Lawrenceville, NJ. Dept. of Geosci-

For primary bibliographic entry see Field 2J. W89-03187

RESPONSE OF COASTAL PLANTS TO IN-CREASE IN SUBMERGENCE AND SALINITY, Louisiana State Univ., Baton Rouge. Lab. for Wet land Soils and Sediments.

land sons and sediments. R. D. DeLaune, S. R. Pezeshki, and W. H. Patrick. Journal of Coastal Research, Vol. 3, No. 4, p 535-546, Autumn 1987. 7 fig, 1 tab, 77 ref.

Descriptors: *Environmental impact, *Air pollu-tion effects, *Greenhouse effect, *Saline wetlands, *Submerged plants, *Marsh plants, *Sea level, Rising stage, Plant populations, Submerged lands, Water level fluctuations, Saline-freshwater inter-

Increases in salinity and submergence resulting from the predicted rise in global sea level will alter regional patterns of wetland distribution. Changes in coastal wetland soil physicochemical properties due to increased flooding will adversely influence normal plant metabolic functioning and consequently survival and growth of coastal plant species. Increased flooding along coastal regions will cause more rapid and frequent soil oxygen depletion. As alternate electron acceptors become reduced, and redox potential decreases, potentially toxic compounds tend to accumulate causing alternations in normal plant substrate conditions. These changes will alter present plant-soil interactions changes will alter present plant-soil interactions characteristic of flooded systems which in turn will affect physiological functions of wetland macro-phytes. The combination of flooding and salinity phytes. The combination of flooding and salimity stresses will change plant productivity, species dis-tribution, and successional patterns of plant com-munities in coastal regions. Likewise, there will be conversion of wetland to open water if plant com-munities cannot compensate for predicted increases in coastal submergence. (Author's abstract) W89-03188

INFLUENCE OF A RIVER PLUME ON THE SEA-ICE MEIOFAUNA IN SOUTH-EASTERN HUDSON BAY, Arctic Biological Station, Ste. Anne de Bellevue

Est. H. Grainger. Estuarine, Coastal and Shelf Science ECSSD3, Vol. 27, No. 2, p 131-141, August 1988. 6 fig, 3 tab,

Descriptors: *Hudson Bay, *Ice-water interfaces, *River mouth, *Sea ice, *Aquatic animals, *Plumes, Saline-freshwater interfaces, Nematodes, Copepods, Zooplankton, Aquatic populations.

Outflow from the Great Whale River produces a substantial freshwater layer (plume) beneath the winter ice cover and above water of higher salinity in southeastern Hudson Bay. In 1983, samples of the lower-ice fauna and of zooplankton beneath the ice, were taken within, below and beyond the offshore reach of the plume. Nematodes accounted

for the highest numbers (mean of 1956/L in the for the highest numbers (mean of 1956/L in the lower 3 cm of ice), and copepods, mainly Harpacticus and Halectinosoma with fewer Tisbe and Oithona, for the greatest biomass. All ice-inhabiting taxa were also found in the water below the ice, but many zooplankters occurring immediately beneath the ice did not form part of the ice fauna. No major qualitative differences were evident between the ice communities existing above the plume and offshore from it, but quantitative distinctions were readily apparent. Animals were consistently more concentrated (by 2-3 orders of magnitude) in the lower 3 cm of the ice than in the water immediately below, both over the plume and outside. lower 3 cm of the ice than in the water immediate; below, both over the plume and outside it. Except for the dominant rotifers in the plume, the concentration of zooplankton there was only 10% of that found in the surface water outside the plume. The river plume exerts a strong influence over the quantity of the fauna in the sea ice immediately above it. Changes in location and extent of the plume, therefore, may have an important effect on the food chain based in the sea ice. (Author's abstract) abstract) W89-03189

CYCLING OF METHANE, CARBON MONOX-IDE, NITROUS OXIDE, AND HYDROXYLA-MINE IN A MEROMICTIC, COASTAL LAGOON,

Oregon State Univ., Corvallis. Coll. of Oceanogra-

J. H. Butler, J. E. Pequegnat, L. I. Gordon, and R. D. Jones.

Estuarine, Coastal and Shelf Science ECSSD3, Vol. 27, No. 2, p 181-203, August 1988. 6 fig, 7 tab, 69 ref. NSF Grant OCE-8409069 and OCE-8519210.

Descriptors: *Coastal waters, *Lagoons, *Nitrogen cycle, *Carbon cycle, *Meromictic lakes, *Methane, *Carbon monoxide, Air-water interfaces, Microbial degradation, Diffusion, Vertical distribution. Nitrogen compounds.

The vertical distributions of methane, carbon monoxide, nitrous oxide, and hydroxylamine were measured in a seasonally stratified, coastal lagoon in northern California. The production of gases was estimated from mass-balance calculations where possible, including considerations of diffusion and microbial oxidation. From late spring through most of the summer the lagoon remained oligotrophic, with biological activity concentrated near the pycnocline and the sediments. Methane, attaining high levels of supersaturation, was produced mainly in the sediments and in the metalimnion. Its subsequent fate was governed primarily by transport, but also by microbial activity. Carbon monoxide also reached high concentrations, but, having a turnover time of a few hours, was regulated almost entirely by micro-organisms. tions, but, naving a turnover time of a tew hours, was regulated almost entirely by micro-organisms. Nitrous oxide production was evident near the halocline throughout most of the study, but was apparent near the sediments only in the spring. Throughout the summer, N2O in the hypolimnion was consumed in the sediments, presumably by denitrification. Hydroxylamine was present in the dentifrication. Trydroxylamine was present in the spring when nitrous oxide was being consumed. Nitrous oxide distribution, like that of methane, was governed by diffusion and microbial processes, but hydroxylamine, with estimated turnover times of only a few hours, was probably regulated my microbes and in situ chemical oxidation. (Author's abstract)

TEMPORAL VARIATIONS IN DISSOLVED AND PARTICULATE ALUMINUM DURING A SPRING BLOOM,

Dalhousie Univ., Halifax (Nova Scotia). Dept. of

Oceanography.
S. B. Moran, and R. M. Moore.
Estuarine, Coastal and Shelf Science ECSSD3,
Vol. 27, No. 2, p 205-215, August 1988. 5 fig, 1 tab,

Descriptors: *Nutrients, *Aluminum, *Metals, *Algal blooms, *Coastal waters, *Marine environment, Temporal distribution, Dissolved solids, Particulate matter, Canada.

Estuaries—Group 2L

Dissolved and acetic acid leachable particulate Al ((Al)HAc) concentrations have been measured as a time series during a spring phytoplankton bloom in Bedford Basin off Nova Scotia, Canada. Two factors were observed to influence Al levels: the spring bloom and river runoff. Changes in dissolved Al and (Al)HAc associated with intense biological activity resulted in a 55-65 nm (40%) decrease in dissolved Al and a coincident similar increase in (Al)HAc over 15-20 days. The intensity of Al removal is apparently a function of biogenic particle loads. A pulse in river runoff caused dissolved Al to increase roughly 10 fold (up to 175 nm) in the surface 5 m. These data indicate that biological activity can significantly alter concentrations of Al in coastal waters and distributions among dissolved and particulate forms. In the presence of strong sources, such as river runoff, these effects can be obscured. (Author's abstract) W89-03192 Dissolved and acetic acid leachable particulate Al W89-03192

HURRICANE-INDUCED SEDIMENT DEPOSI-TION IN A GULF COAST MARSH, California Univ., Davis. Dept. of Botany. For primary bibliographic entry see Field 2J.

W89-03193

HYDROGEN (H2) DISTRIBUTIONS IN THE CARMANS RIVER ESTUARY,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
R. H. Michener, M. I. Scranton, and P. Novelli.

R. H. Micheler, M. I. Scranton, and T. F. Novelin. Estuarine, Coastal and Shelf Science ECSSD3, Vol. 27, No. 2, p 223-235, August 1988. 5 fig. 38 ref. ONR Contract N00014-80-C-0771 and NSF Grants OCE 84-00107 and OCE 85-00270.

Descriptors: *Anoxic environments, *Hydrogen, *Estuaries, *Saline-freshwater interfaces, *Interstitial water, *Bottom sediments, Sediments, Biochemistry. Geochemistry

chemistry, Geochemistry.

Hydrogen concentrations in anoxic environments are controlled by relative rates of production (by fermentative processes) and consumption (largely by sulfate reducers and methanogens). Because the relative importance of the two consumption pathways depends on the presence or absence of sulfate, hydrogen concentrations would be expected to vary along the salimity gradient of an estuary. We have examined the distribution of hydrogen in the sediments of the Carmans River Estuary on Long Island. In this estuary, hydrogen concentrations range from several hundred nanomoles hydrogen per liter pore water in the freshwater sediments at the head of the estuary, to lower values (20-30 nM) in the sediments from the estuary month. These results are consistent with the hypotheses that sulfate reducers (active only in sulfate-containing sediments) are more efficient at consuming hydrogen than are methanogens. Methanogens may also require higher threshold hydrogen concentration before uptake can begin than do sulfate reducers. (Author's abstract)

W89-03194 W89-03194

HEXACHLOROPHENE DISTRIBUTIONS IN ESTUARINE SEDIMENTS.

For primary bibliographic entry see Field 5B.

VOLATILIZATION OF MERCURY COM-POUNDS BY METHYLMERCURY-VOLATIL-IZING BACTERIA IN MINAMATA BAY SEDI-MENT.

National Inst. for Minamata Disease, Minamata (Japan). Dept. of Basic Medical Science. For primary bibliographic entry see Field 5B. W89-03197

DDT RESIDUES IN SEDIMENTS FROM THE

DDI RESIDUES IN SEDIMENTS FROM THE BAY OF BENGAL, National Inst. of Oceanography, Panaji (India). Chemical Oceanography Div. For primary bibliographic entry see Field 5B. W89-03198

ACUTE TOXICITY OF MALATHION, TETRA-BROMOBISPHENOL-A, AND TRIBUTYLTIN CHLORIDE TO MYSIDS (MYSIDOPSIS BAHIA) OF THREE AGES, Environmental Protection Agency, Gulf Breeze, FL. Gulf Breeze Environmental Research Lab. For primary bibliographic entry see Field 5C. W89-03203

EFFECTS OF WATER SOLUBLE CRUDE OIL FRACTIONS ON CIRRAL BEAT FREQUENCY IN BALANUS BALANOIDES,

Kiel Univ. (Germany, F.R.). Inst. fuer Meeres-For primary bibliographic entry see Field 5C. W89-03205

INTERRELATIONSHIP BETWEEN IN VIVO FLUORESCENCE OF PHYTOPLANKTON AND LIGHT BEAM TRANSMISSION WITH REFERENCE TO FLUORESCENCE YIELD,

Laval Univ., Quebec. Dept. de Biologie.
T. Vandevelde, L. Legendre, S. Demers, and J.

Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 9, p 1508-1513, September 1988. 5 fig, 29 ref.

Descriptors: *Fluorescence, *Water properties, *Light penetration, *Stratification, *Biomass, Phytoplankton, Stream biota, Chlorophyll, Estuaries, On-site data collections, Euphotic zone, Saint Lawrence Estuary, Canada, Primary productivity.

In vivo fluorescence and light beam transmission were simultaneously recorded during two cruises in the St. Lawrence estuary. Marked differences in the relationship between light beam attenuation (c(660)) and in vivo fluorescence (IVF) were observed (1) along a short transect and (2) between surface (< 5 m) and underlying waters (5-15 m) for a series of vertical profiles at an anchor station. In both cases, the observed differences were related to changes in fluorescence yield. At the anchor station, however, several other factors could also have affected the c(660)-IVF relationship. Below 5 m, tight linear relationships between c(660) and IVF indicate that no major change took place in either fluorescence yield or the concentration of chlorophill per cell. In such a case, the two measurements provide consistent estimates of phytourements provide consistent estimates of phyto-plankton biomass. (Author's abstract) W89-03233

HIGH-PRECISION RESPIROMETER FOR MEASURING SMALL RATES OF CHANGE IN THE OXYGEN CONCENTRATION OF NATU-RAL WATERS.

Georgia Univ., Athens. Inst. of Ecology. For primary bibliographic entry see Field 7B. W89-03252

KINETIC CONTROL OF DISSOLVED PHOS-PHATE IN NATURAL RIVERS AND ESTU-ARIES: A PRIMER ON THE PHOSPHATE BUFFER MECHANISM, Lamont-Doherty Geological Observatory, Pali-

sades, NY. For primary bibliographic entry see Field 2K. W89-03253

NITROGEN FIXATION IN FRESHWATER, ESTUARINE, AND MARINE ECOSYSTEMS: 1. RATES AND IMPORTANCE, Cornell Univ., Ithaca, NY. Section of Ecology and

For primary bibliographic entry see Field 2H. W89-03254

NITROGEN FIXATION IN FRESHWATER, ESTUARINE, AND MARINE ECOSYSTEMS: 2. BIOGEOCHEMICAL CONTROLS,

Cornell Univ., Ithaca, NY. Section of Ecology and Systematics. For primary bibliographic entry see Field 2H. W89-03255

DENITRIFICATION IN FRESHWATER AND COASTAL MARINE ECOSYSTEMS: ECOLOGICAL AND GEOCHEMICAL SIGNIFICANCE, Academy of Natural Sciences of Philadelphia, PA. Div. of Environmental Research. For primary bibliographic entry see Field 2H. W89-03256

COMPARISON OF MICROBIAL DYNAMICS IN MARINE AND FRESHWATER SEDI-MENTS: CONTRASTS IN ANAEROBIC CARBON CATABOLISM,

State Univ. of New York at Stony Brook. Marine Sciences Research Center. For primary bibliographic entry see Field 2H. W89-03257

COMPARISON OF THE ECOLOGY OF PLANKTONIC BACTERIA IN FRESH AND SALT WATER,

Marine Biological Lab., Woods Hole, MA. Eco-systems Center. For primary bibliographic entry see Field 2H. W89-03258

PHOTOTROPHIC PICOPLANKTON: AN OVERVIEW FROM MARINE AND FRESHWA-TER ECOSYSTEMS,

Department of Fisheries and Oceans, Vancouver (British Columbia). West Vancouver Lab. For primary bibliographic entry see Field 2H. W89-03259

COMPARATIVE ECOLOGY OF MARINE AND FRESHWATER PHYTOPLANKTON,

Michigan Univ., Ann Arbor. Dept. of Biology. For primary bibliographic entry see Field 2H. W89-03260

NUTRIENT LIMITATION OF PHYTOPLANK-TON IN FRESHWATER AND MARINE ENVI-RONMENTS: A REVIEW OF RECENT EVI-DENCE ON THE EFFECTS OF ENRICHMENT, Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst. For primary bibliographic entry see Field 2H.

W89-03261

NUISANCE PHYTOPLANKTON BLOOMS IN COASTAL, ESTUARINE, AND INLAND COASTAL, WATERS,

North Carolina Univ., Morehead City. Inst. of Marine Science For primary bibliographic entry see Field 2H. W89-03262

FACTORS CONTROLLING THE BIOGEOCHE-MICAL CYCLES OF TRACE ELEMENTS IN FRESH AND COASTAL MARINE WATERS AS REVEALED BY ARTIFICIAL RADIOISO-TOPES,

Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Due-bendorf (Switzerland).

For primary bibliographic entry see Field 2H. W89-03263

COMPARATIVE ECOLOGY OF SUBMERSED GRASS BEDS IN FRESHWATER, ESTUARINE, AND MARINE ENVIRONMENTS,

Maryland Univ., Cambridge. Horn Point Environ-mental Labs. For primary bibliographic entry see Field 2H. W89-03264

FORESTED WETLANDS IN FRESHWATER AND SALT-WATER ENVIRONMENTS,

Institute of Tropical Forestry, Rio Piedras, PR. For primary bibliographic entry see Field 2H.

Field 2—WATER CYCLE

Group 2L—Estuaries

PRODUCTION AND USE OF DETRITUS IN VARIOUS FRESHWATER, ESTUARINE, AND COASTAL MARINE ECOSYSTEMS, Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab. For primary bibliographic entry see Field 2H. W89-03266

ECOLOGICAL PRINCIPLES AFFECTING COMMUNITY STRUCTURE AND SECONDARY PRODUCTION BY ZOOPLANKTON IN MARINE AND FRESHWATER ENVIRON-MENTS

Michigan Univ., Ann Arbor. Dept. of Biology. For primary bibliographic entry see Field 2H. W89-03267

COMPARATIVE ECOLOGY OF THE MACRO-FAUNA OF FRESHWATER AND MARINE

MUDS, State Univ. of New York at Stony Brook. Marine Sciences Research Center. For primary bibliographic entry see Field 2H.

ACCOUNTING FOR EFFORT WHEN COM-PARING TROPICAL FISHERIES IN LAKES, RIVER-FLOODPLAINS, AND LAGOONS, Illinois Natural History Survey, Champaign. For primary bibliographic entry see Field 2H. W89-03269

APPLICABILITY OF FISH YIELD INDICES IN FRESHWATER AND MARINE ECOSYSTEMS, Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab. For primary bibliographic entry see Field 2H. W89-03270

FRESHWATER AND MARINE COUPLING IN ESTUARIES OF THE MISSISSIPPI RIVER DELTAIC PLAIN, Louisiana State Univ., Baton Rouge. Center for Wetland Resources.

For primary bibliographic entry see Field 2E. W89-03271

PHYSICAL ENERGY INPUTS AND THE COM-PARATIVE ECOLOGY OF LAKE AND

Rhode Island Univ., Narragansett. Graduate School of Oceanography. For primary bibliographic entry see Field 2A. W89-03272

EFFECTS OF TEMPERATURE, SALINITY AND SEAGRASS SPECIES ON THE UPTAKE OF LEAD(II) FROM SEAWATER BY EXCISED

LEAVES, Deakin Univ., Melbourne (Australia). Div. of Chemical and Physical Sciences. For primary bibliographic entry see Field 5B. W89-03275

TRACE METAL TRANSPORT IN A TROPICAL

ESTUARY, Skidaway Inst. of Oceanography, Savannah, GA. H. Windom, R. Smith, C. Rawlinson, M. H. windon, R. Shindi, C. Rawinson, M. Hungspreugs, and S. Dharmvanii. Marine Chemistry MRCHBD, Vol. 24, No. 3/4, p 293-305, August 1988. 8 fig, 1 tab, 27 ref. NSF Grants INT-8318019 and OCE-8600287.

Descriptors: *Trace metals, *Estuaries, *Tropical regions, *Thailand, *Bang Pakong Estuary, *Water chemistry, *Organic carbon, Lead, Iron, Cadmium, Cycling nutrients, Cobalt, Zinc, Heavy

The distributions of soluble and particulate trace metals in the Bang Pakong Estuary, Thailand, were studied during high (wet) and low (dry) discharge conditions. Particulate trace metals and particulate organic carbon concentrations are con-trolled by physical processes. Dissolved copper

and nickel are, in general, conservatively mixed through the estuary. The behavior of iron and lead result in net removal during estuarine transport. Iron removal appears to be due to decreased solu-Iron removal appears to be due to decreased solubility as pH increases in estuarine waters. Mn is removed at low salimities. Dissolved cadmium, cobalt and zinc concentration distributions have mid-estuary maxima which coincide with nutrient maxima. The metal-nutrient relationship is interpreted as the result of metal regeneration during the organic matter decomposition. (Author's abstract) W89-03276

IODINE SPECIATION IN CHESAPEAKE BAY WATERS, Delaware Univ., Lewes. Coll. of Marine Studies.

G. W. Luther, and H. Cole. Marine Chemistry MRCHBD, Vol. 24, No. 3/4, p 315-325, August 1988. 4 fig. 1 tab, 21 ref. NSF Grants OCE-8696121 and OCE-8511390.

Descriptors: *Iodine, *Chesapeake Bay, *Salinity, *Estuaries, *Water chemistry, *Geochemistry, *Polarographic analysis, *Speciation, Halogens, Oxidation-reduction potential, Tracers.

The speciation of iodine in Chesapeake Bay during July 1986 is reported. Surface and bottom water samples were taken along the estuary at every 1-2 ppt salinity division. At three locations in the upper bay, samples were taken above and below the pyenocline. All samples were analyzed by differential pulse polarography. Iodate was deterferential pulse polarography. Iodate was determined directly. Total iodine (including organic mined directly. Total iodine (including organic forms) was determined by hypochlorite oxidation to iodate. Iodide is defined as the difference between these two analyses. Total iodine appears to be conservative in the estuary. In all samples from the upper bay only reduced forms of iodine were present. Iodine is maintained in its reduced state by biological processes in the surface waters and by a combination of biological and chemical processes in the anoxic bottom waters. Iodate was present only in water samples at mid-depth and the bottom in the lower bay. Iodate comes from oceanic water in the lower bay. Iodate comes from oceanic water intruding up the bay and decreases in concentration up the bay as the result of its reaction with reducing agents in the anoxic bottom waters. the forms of iodine in the waters of Chesapeake Bay can be used as a geochemical tracer. These results differ from previous reports in two other estuaries on the speciation of iodine in the water column. (Author's astract)

W89-03277

MASS BALANCE OF HEAVY METALS IN THE SETO INLAND SEA, JAPAN, Government Industrial Research Inst., Chugoku,

Kure (Japan). For primary bibliographic entry see Field 5B. W89-03278

SPREX HYDROGRAPHIC DATA REPORT, VOLUME 3 -- CHLOROPHYLL AND NUTRI-

Old Dominion Univ. Research Foundation, Nor-folk, VA. W. S. Chandler, K. A. Bush, C. Kim, T. J. Berger, and L. P. Atkinson.

and L. P. AKKINSON.
Available from the National Technical Information Service, Springfield, VA 22161, as DE88-004103. Price codes: Al 0 in paper copy, AO1 in microfiche. Report No. DOE/ER/60348-6, December 1987. Technical Report 87-11. 241p, 3 fig, 1 tab, 4 ref. DOE Grant DE-FG05-85ER60348.

Descriptors: *Water circulation, *Chlorophyll, *Nutrients, *Coastal waters, Continental shelf, Georgia, South Carolina, Mapping, Data collections, Nitrites, Nitrates, Phosphates, Slicates, Sa linity, Water temperature, Path of pollutants

SPREX (Spring Removal Experiment) took place in April 1985 in order to determine the processes affecting the transport and fate of freshwater input to the continental shelf off Georgia and South Carolina during the time of expected high runoff. It was hypothesized that this water is transported offshore in spring by a semi-permanent cyclonic

eddy located at about 32 deg 79 deg deg W. The SPREX field program included a large array of moored current meters and other instruments, and three research vessels (R/V Cape Florida, R/V Cape Hatteras, and R/V Blue Fin) that conducted hydrographic mapping and biological and chemical sampling. Nutrient analysis for nitrate/nitrite, phosphate, and silicate concentrations took place at Old Dominion University using a Technicon Autoanalyzer II. Chlorophyll analysis took place at Skidaway Institute of Oceanography. The data are presented in graphic and tabular form in the following order: Temperature vs Salinity, Temperature vs Nutrients and Nutrients vs Nutrients or CF (R/V Cape Florida); Temperature vs Salinity, Temperature vs Nutrients and Nutrients vs Nutrients for CH (R/V Cape Hatteras); Chlorophyll vs several parameters for CF; Chlorophyll vs several parameters for CF; List of stations in each Section for CF; Nutrient and Chlorophyll Vertical Section for CM. for CF; Nutrient and Chiorophyll Vertical Section for CH; Nutrient and Chiorophyll Vertical Section for CH; Nutrient and Chlorophyll Vertical Section plots for CH; Station listing explanation; Station listing for CF; Station listing for CH; and Station listing for BF. (Lantz-PTT)

W89-03323

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DESALINATION OF WATER. CITATIONS FROM THE COMPENDEX ENGINEERING IN-FORMATION, INC. DATABASE (DEC 83 - SEP

National Technical Information Service, Spring-

Available from the National Technical Information Service, Springfield, VA. 22161, as PB87-868337. Price codes: NO1 in paper copy, NO1 in micro-fiche. October 1987. 34p.

Descriptors: *Bibliographies, *Desalination, Literature review, Industrial water, Electrodialysis, Reverse osmosis, Ion exchange, Corrosion, Scaling.

This bibliography contains citations concerning the industrial desalination of water, with particular reference to large scale plants in the Middle East. Methods include electrodialysis, reverse osmosis, and ion exchange. Problems associated with corrosion and scale formation are also discussed. This industrial in the problems in the control of the problems in the control of the updated bibliography contains 87 citations (13 of which are new entries). (Author's abstract) W89-02782

USING DESALINATION TECHNOLOGIES FOR WATER TREATMENT.

Office of Technology Assessment, Washington,

Available from the National Technical Information Service, Springfield, VA. 22161, as PB88-193354. Price codes: A04 in paper copy, A01 in microfiche. Background Paper, 1986. 66p, 13 fig, 4 tab, 93 ref,

Descriptors: *Desalination, *Water treatment, Reverse osmosis, Electrodialysis, Membrane processes, Distillation, Costs, Environmental effects, Government supports.

Technologies that were originally developed to desalinate water are widely applied to remove contaminants other than salt from freshwater supplies. Of the many available desalination technologies, two membrane processes (reverse osmosis and electrodialysis) are most widely used in the and electrodialysis) are most widely used in the United States. Such widespread use would not have been possible without the advances made in membrane technology over the last two decades, due largely to federally sponsored research and development. This report represents a technical assessment of traditional desalination techniques that can be used for untertreatment. These states that can be used for untertreatment. that can be used for water treatment. These techniques include distillation, as well as more recently developed membrane processes. Applications

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

Conservation In Agriculture—Group 3F

costs, environmental considerations, the desalination industry, government involvenment, interna-tional aspects, and future prospects for desalination in the United States are considered. (Lantz-PTT)

3B. Water Yield Improvement

EVAPOTRANSPIRATION OF PHREATO-PHYTES IN THE SAN LUIS VALLEY, COLO-

Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 2D. W89-02478

EVAPOTRANSPIRATION OF NATIVE VEGE-TATION IN THE CLOSED BASIN OF THE SAN LUIS VALLEY, COLORADO, Colorado State Univ., Fort Collins. Dept. of Agri-cultural and Chemical Engineering. For primary bibliographic entry see Field 2D. W89-02481

RECHARGE AS AUGMENTATION IN THE SOUTH PLATTE BASIN,
Colorado State Univ., Fort Collins. Dept. of Civil

Engineering.
For primary bibliographic entry see Field 4B.
W89-02482

EVAPOTRANSPIRATION RATES AT SELECT-ED SITES IN THE POWDER RIVER BASIN, WYOMING AND MONTANA, Geological Survey, Cheyenne, WY. Water Re-

Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2D.
W89-02524

DIAGNOSTIC TECHNIQUE FOR TARGETING DIAGNOSTIC TECHNIQUE FOR TARGETING DURING AIRBORNE SEEDING EXPERIMENTS IN WINTERTIME STORMS OVER THE SIERRA NEVADA, Electronic Techniques, Inc., Fort Collins, CO. For primary bibliographic entry see Field 2B. W89-03305

ESTIMATE OF PRECIPITATION ENHANCE-MENT POTENTIAL FOR THE DUERO BASIN OF SPAIN,

Wyoming Univ., Laramie. Dept. of Atmospheric

Science, G. Vali, L. R. Koenig, and T. C. Yoksas. Journal of Applied Meteorology JAMOAX, Vol. 27, No. 7, p 829-850, July 1988. 12 fig. 5 tab, 24 ref, append. NSF grants ATM 7825286 and ATM 8022549.

Descriptors: *Estimating, *Precipitation, *Spain, *Cloud seeding, *Weather modification, *Model studies, Seasonal variation, Ice nuclei, Model stud-

Procedures for estimating the potential which might exist for the enhancement of precipitation from different cloud types via ice-nucleus seeding of clouds. Field investigations for the Precipitation Enhancement Project were undertaken during the winter months of 1979-1981 in the upper Duero River Basin of Spain. Specific regions within natural clouds were qualified as potentially seedable on ral clouds were qualified as potentially seedable on the basis of observations by instrumented aircraft of persistent zones of supercooled water content. The observed regions of potential are described, and precipitation increases that might result from seeding the regions are estimated using two relatively simple models. Summed over all cloud types, and expressed as averages over the 100-km radius project area, increases of 10% and 23% are estimated with the two models for the days of seeding. For the February-May season as a whole, the increases are 0.75% and 1.8% of the normal precipitation (160 mm) for the season. The major contributions to these increases come from cumulus mediocris and cumulus congestus, and from lus mediocris and cumulus congestus, and from shallow stratiform and clouds. The low values

obtained for the estimated increases indicate that a major augmentation of total seasonal precipitation in the Duero Basin is not likely to result from seeding the regions of potential. Consequently, within a 5-year period envisaged for the project, it would be difficult to discern a seeding effect in terms of area-averaged precipitation. Useful increases in precipitation may possibly be produced by seeding the regions of potential, but the demonstration of the seeding effects would have to be based on evaluations which are focused (in time and space) on the treated clouds or cloud regions. Since no seeding was actually carried out during. obtained for the estimated increases indicate that a and space) on the treated clouds or cloud regions. Since no seeding was actually carried out during, or subsequent to, these field studies, the validity of the criteria employed for defining the regions of potential and the derived estimates remain unverified. The criteria which define the regions of potential and the methods of estimation developed in this study can also be applied, in principle, where precipitation enhancement is sought via seeding with ice nuclei. (Author's abstract)

3C. Use Of Water Of Impaired Quality

USE OF SALINE WATER FOR BUFFALO GOURD PRODUCTION IN NEW MEXICO, New Mexico Solar Energy Inst., Las Cruces. J. Whitter, and B. Goldstein.

Available from the National Technical Information Service, Springfield, VA 22161, as PB87-205803/AS. Price codes: A03 in paper copy; A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces. Technical Completion Report No. 214, November 1986. 27p, 4 tab, 9 fig, 11 ref. State Project 1423625.

Descriptors: *Buffalo gourds, *Salt tolerance, *New Mexico, Ethanol, Crop yield, Irrigation water, Saline water, Dissolved solids.

New Mexico's underground water resources include over 15 billion acre-feet of saline water of varying salinity levels. Salt tolerant crops that are capable of producing commercial yields economically may displace more conventional crops and spare the state's precious freshwater for higher uses. Cucurbita foetidissima HBK (buffalo gourd) was grown in wooden tubs in an outdoor setting in an effort to determine starch and alcohol solids were applied. Irrigation waters of 500; 2,000; 4,000; and 8,000 ppm total dissolved solids were applied. Yields of buffalo gourd roots from 2,000 ppm TDS irrigation water were comparable with field trials. Lower root yields were experienced with increasirrigation water were comparable with field trials. Lower root yields were experienced with increasing salinity levels. Alcohol yields were lower for buffalo gourds irrigated with saline water than for field grown buffalo gourds. Results are inconclusive as to why low alcohol yields were achieved. (Whittier-NM St. U.) W89-02475

ECONOMIC AND ENVIRONMENTAL IM-PACTS OF USING MUNICIPAL SEWAGE EF-FLUENT FOR AGRICULTURAL PRODUC-

Oklahoma State Univ., Stillwater. Dept. of Agri-Cultural Economics.
For primary bibliographic entry see Field 5E.
W89-02663

3F. Conservation In Agriculture

PRINCIPLES OF FARM SYSTEM DESIGN, Washington State Univ., Pullman. L. G. James. OF FARM IRRIGATION

Descriptors: *Irrigation design, *Farming, *Text-books, Irrigation requirements, Agricultural engi-neering, Design criteria, Pumps, flow measure-ment, Mathematical equations, Computer pro-

Wiley and Sons, New York. 1988. 543p.

This introduction to irrigation is designed to guide students from a basic knowledge of soils, botany,

mathematics, and hydraulics to state-of-the-art irrigation system design and management. The following topics are covered: irrigation requirements and scheduling, farm irrigation systems and system design fundamentals, water source quality and scheduning, iaim intigation 37steris and 37steris design fundamentals, water source quality and quantity, pumps, spinkle irrigation systems, trickle irrigation, surface irrigation, and flow measurement. The book contains 60 solved example problems, FORTRAN code for seven computer programs, 197 homework problems, and more than 100 references for student use and enrichment. Most of the 177 equations in the book have a unit constant, K, which allows the use of either SI or English units. (Lantz-PTT)

MICROCOMPUTER PROGRAM DEVELOP-MENT FOR ON-FARM IRRIGATION SYS-TEMS PLANNING,

Idaho Univ., Moscow. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 6A. W89-02550

GROUND WATER QUALITY AND AGRICUL-

TURAL PRACTICES.
Lewis Publishers, Chelsea, Michigan. 1987. 402p.
Edited by Deborah M. Fairchild.

Descriptors: *Water quality, *Groundwater, *Agriculture, Wastewater, Wells, Conservatism, Pesticides, Fertilizers.

A national conference on groundwater quality and agricultural practices was held May 1-2, 1986, at the University of Oklahoma in Norman. The conference addressed groundwater usage, agricultural chemical usage, groundwater pollution sources and evaluation, and protection and management. Attendees were soil scientists, hydrologists, geologists, engineers, agronomists, and scientists from government agencies, industry, universities, congists, engineers, agronomists, and scientists from government agencies, industry, universities, con-sulting firms, and professional and trade organiza-tions. This book contains twenty-seven chapters resulting from the presentations made at the con-ference. (See W89-02655 thru W89-02681) (Davis-PTT W89-02654

U.S.D.A. AGRICULTURAL RESEARCH SERV-ICE COMMITMENT TO GROUND WATER RESEARCH,

Agricultural Research Service, Bushland, TX. B. A. Stewart.

IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p 1-5.

Descriptors: *Management planning, *Administra-tive agencies, *Research priorities, *Groundwater, *Agriculture, Conservation, Research, Pesticides, Salinity, Nutrients.

General comments about the planning strategy of the Agricultural Research Service (ARS) in the climate of increasing fiscal constraint are made. The ARS commitment to ground water research is discussed. The emphasis on mission-oriented, fun-damental, long regree high with experiments. damental, long-range, high-risk research and the damental, long-range, high-risk research and the responsiveness to action agencies, user groups, and the U.S. Congress is reflected in the projects in the ARS planning strategy. The ARS Program Plan includes six objectives that form the strategy: research to improve soil and water conservation; plant production and protection; animal production and protection; animal production and protection; animal production, using computer technology. The research on soil and water conservation and the research on soil and water conservation and the research on nutrients, pesticides, salinity, and modeling are outnutrients, pesticides, salinity, and modeling are out-lined. Three agriculturally related ground water quality problems are named: occurrence of pesti-cides in ground water; occurrence of nutrients in ground water; and irrigation driven salt-water mi-gration. (See also W89-02654) (Davis-PTT) W89-02655

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F-Conservation In Agriculture

WATER CONSERVATION FOR MORE CROP PRODUCTION IN THE GREAT PLAINS,

PRODUCTION:
PROPOSITION OF THE PROPOSITION OF T

Descriptors: *Water conservation, *Crop production, Agriculture, *Great Plains, Precipitation, Kansas, Evapotranspiration, Mulch, Wheat,

Precipitation is highly variable and limited over much of the Great Plains. Despite the water deficiency, excellent dryland crop production is possi-ble with good soil and water management to in-crease infiltration and minimize needless evaporacrease inflitration and minimize necesses evapora-tion. Western Kanasa farmers have more than tri-pled their average per acre dryland crop yields over the last fifty years while applying approxi-mately half of the needed conservation treatment. mately half of the needed conservation treatment. The added crop production now obtained with water saved by conservation farming exceeds the added production gained by irrigating with pumped ground water. Water conservation on both dryland and irrigated cropland can help achieve significant remaining crop yield potential while easing the demand on declining ground water for crop production. This will give agriculture a promising future in the subhumid and semi-arid Great Plains. (See also W89-02654) (Davis-PTT)

GROUND WATER CONSERVATION TECHNIQUES: POTENTIAL IMPACTS ON WATER USAGE AND QUALITY, Oklahoma State Univ., Stillwater. Dept. of Agri-

Okianoma State Univ., Stiliwater. Dept. of Agri-cultural Economics. H. P. Mapp. 1N: Ground Water Quality and Agricultural Prac-tices. Lewis Publishers, Chelsea, Michigan. 1987. p 35-45, 1 fig, 1 tab, 20 ref.

Descriptors: *Groundwater, *Water conservation, *Water quality, *Water use, Oklahoma, Wheat, Herbicides, Pesticides, Water pollution sources.

Water conservation is described, emphasizing the relationship between tillage practices and irrigation technology; economic and other forces which contechnology; economic and other forces which con-tribute to the increase in adoption of water con-serving technology, and concerns regarding the implications for ground water quality. The discus-sion is based on research conducted in the southern part of the Great Plains where irrigation water is withdrawn from the Ogallala Formation. The impact of the increased use of herbicides and in-creased levels of fertilizer and pesticides relative to dryland production necessary during the transition to dryland crops is uncertain. Adoption of water to dryland crops is uncertain. Adoption of water conservation techniques will reduce runoff and deep percolation and may reduce the likelihood of ground water contamination. Studies of the conversion from intensive irrigation to water conserving irrigation techniques suggest that overall water use may not be reduced; and the economic life of underground aquifers will be extended only if re-duced pumping costs per acre lead to increased profitability from irrigated production. (See also W89-02654) (Davis-PTT) W89-02658

EFFECTS OF IRRIGATION PRACTICES ON STREAM-CONNECTED PHREATIC AQUIFER

SYSTEMS, Oklahoma Univ., Norman. Dept. of Civil Engi-

ONABOURD UNIV., NORMAN. Dept. of Civil Engineering and Environmental Science. S. G. McLin.
IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p. 73-90, 7 fig., 4 tab, 15 ref.

Descriptors: *Groundwater, *Surface-groundwater relations, *Irrigation practices, *Aquifer systems, Streams, Model studies, New Mexico.

Evaluation of irrigation related water management practices on stream-connected phreatic aquifer water quality are examined. A mathematical model is presented that can be used to assess these impacts before proposed alternative water management schemes are put into effect. A model sensitivity analysis suggests that the hydraulic and solute response times are critical parameters in determining how a particular irrigation systems's water quality will respond to these water conservation quality will respond to these water conservation measures. Several water utilization schemes that are simulated include: improvements in irrigation efficiency that reduce the leakage fraction of ap-plied waters; lining of conveyance canals; and changes in the ratio of applied surface to ground waters that are used to satisfy crop water require-ments. These hypothetical system stress patterns are frequently cited as potential ways to reduce irrigation water requirements; however, each of irrigation water requirements; however, each of these conservation techniques will alter the shal-low ground water quality in different ways. A field low ground water quality in different ways. A field application further demonstrates that the model can accurately simulate changes in stream flow and total dissolved solids concentration, in addition to predicting changes in average aquifer total dissolved solids. (See also W89-02654) (Davis-PTT) W89-02661

GROUND WATER CONTAMINATION FROM SALTWATER INTRUSION AND LIMITA-TIONS ON AGRICULTURAL ACTIVITIES, North Texas State Univ., Denton. Inst. of Applied

For primary bibliographic entry see Field 5B. W89-02662

SALINE SEEP ON WHEATLAND IN NORTH-WEST OKLAHOMA, Southern Plains Range Research Station, Wood-

For primary bibliographic entry see Field 5B. W89-02672

FINAL REPORT: LAKE ERIE CONSERVA-TION TILLAGE DEMONSTRATION PROJECTS.

PROJECTS.

Environmental Protection Agency, Chicago, IL.

Great Lakes National Program Office.

Available from the National Technical Information

Service, Springfield, VA 22161, as PB88-209846.

Price codes: A03 in paper copy, A01 in microfiche. 1986, 26p.

Descriptors: *Erosion control, *Conservation tillage, *Lake Erie, Agriculture, Economic aspects, Phosphorus, Herbicides, Agricultural runoff.

For the past four years, projects have been underway in the 31 counties which make up the Western Basin of Lake Erie. These projects, known collectively as the Tri-State Conservation Tillage Demonstration Projects, were designed to help farmers adapt less intensive tillage systems to their farm businesses. The projects have also provided information for farmers and others on the economics of conservation tillage and the impact of conservation tillage and the environment. Conclusions of this effort are: (1) No-till and Ridge-till systems are economically connective with conventional till-economically connective with conventional tilleconomically competitive with conventional tillage in the project area; (2) These conservation tillage systems can result in reduced soil erosion and reduced delivery of critical nutrients such as phosphorus to waters such as Lake Erie; and (3) phosphorus to waters such as Lake Erie; and (3) Although farmers who first try conservation tillage use slightly more herbicide, the additional amount is not significant. Specific information is provided on certain aspects of the project performed during 1985. The work done during the four years of the project is summarized. (See also W89-02837) project is s

LAKE ERIE CONSERVATION TILLAGE DEM-ONSTRATION PROJECTS: EVALUATING MANAGEMENT OF PESTICIDES, FERTILIZ-ER, RESIDUE TO IMPROVE WATER QUAL-ITY.

ITY.

Environmental Protection Agency, Chicago, IL.

Great Lakes National Program Office.

Available from the National Technical Information

Service, Springfield, VA 22161, as PB88-209838.

Price codes: A03 in paper copy, A01 in microfiche.

1985. 20p, 14 tab.

Descriptors: *Conservation, *Agriculture, *Water pollution prevention, *Conservation tillage, *Lake Erie, Water quality control, Water pollution control, Farming, Phosphorus, Lake Ontario, Lake Huron, Herbicides, Crop yields, Saginaw Bay.

The practice of conservation tillage in the drainage The practice of conservation tillage in the drainage basin of the lower Great Lakes was given new importance during 1984 when states in the basin began the preparation of new programs to reduce phosphorus loadings to Lake Erie, Lake Ontario, and Saginaw Bay of Lake Huron. The strategies being developed by the states of Indiana, Ohio, Michigan, New York, and Pennsylvania, in general, rely heavily on conservation tillage practices to reduce the delivery of phosphorus to the lakes. In part, this reliance on tillage programs is based on the success of the Tri-State Conservation Tillage Demonstration Projects, which have been underthe success of the 1n-State Conservation Hillage Demonstration Projects, which have been underway for the past three years in the Western Basin of Lake Erie. This report covers experience during 1984 in these projects. (See also W89-02835) (Lantz-PTT)

SCHISTOSOMIASIS CONTROL IN IRRIGA-TION SCHEMES IN ZIMBABWE, Hydraulics Research Ltd., Wallingford (England). For primary bibliographic entry see Field 5G. W89-03066

MODEL FOR PREDICTING THE EFFECT OF DRAINAGE ON SOIL MOISTURE, SOIL TEM-PERATURE AND CROP YIELD,

Helsinki Univ. of Technology, Espoo (Finland). Lab. of Hydrology and Water Resources Engineering.
For primary bibliographic entry see Field 4A.

W89-03334

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A, Control Of Water On The Surface

STATISTICAL ANALYSES OF FLOOD FRE-QUENCY, LOW-FLOW FREQUENCY AND FLOW DURATION OF STREAMS IN THE PHILADELPHIA AREA, PENNSYLVANIA, Geological Survey, Harrisburg, PA. Water Re-For primary bibliographic entry see Field 2E. W89-02492

TECHNIQUE FOR ESTIMATING FLOOD-PEAK DISCHARGE AND FREQUENCIES ON RURAL STREAMS IN ILLINOIS, Geological Survey, Urbana, IL. Water Resources

For primary bibliographic entry see Field 2E. W89-02512

HYDROLOGIC RECONNAISSANCE OF THE HYDROLOGIC RECONNAISSANCE OF THE CHILKAT RIVER BASIN, SOUTHEAST ALASKA (WITH SPECIAL REFERENCE TO THE BALD EAGLE CRITICAL HABITAT AT THE TSIRKU RIVER ALLUVIAL FAN),

Geological Survey, Anchorage, AK. Water Resources Div.

For primary bibliographic entry see Field 2E. W89-02565

ANNUAL REPORT, 1986 (RESERVOIR CONTROL CENTER, SOUTHWESTERN DIVISION, U.S. ARMY CORPS OF ENGINEER), Army Engineer Div. Southwestern, Dallas, TX. Available from the National Technical Information Service, Springfield, VA. 22161, as AD-A182 634. Price codes: A10 in paper copy, A01 in microfiche.

WATER QUANTITY MANAGEMENT AND CONTROL FIELD 4

Control Of Water On The Surface—Group 4A

January 1987. 196p, 17 fig, 21 tab, 17 plates, append

Descriptors: *Water resources management, *Reservoir management, Reservoirs, Water management ment, Water quality, Corps of Engineers

The South Western Division Resource Control Center, Corps of Engineers which covers Texas, New Mexico, Arkansas and part of Oklahoma, Nebraska, and Louisiana, was established in 1967 by the Chief of Engineers to improve capabilities of the Corps of Engineers to perform its civil works mission as related to operation of reservoirs. This report presents activities and accomplishments of the Southwestern Division as related to reservoir regulation and water management activities. reservoir regulation and water management activities throughout FY 1986. Detailed summaries of nes tnrougnout FY 1986. Detailed summaries of reservoir conditions, water quality activities, min-utes of coordinating committee meetings and min-utes of the 1986 Water Management meeting are also included. (Lantz-PTT) W89-02716

EROSION AND SEDIMENTATION, Exeter Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2J. w89-02729.

HYDROLOGY VERSUS WATER RESOURCES MANAGEMENT, Slovenska Akademia Vied, Bratislava (Czechoslo-

vakia). Ustav Hydrologie a Hydrauliky. For primary bibliographic entry see Field 2A. W89-02724

FLOOD HAZARD MANAGEMENT: BRITISH AND INTERNATIONAL PERSPECTIVES. Geo Books, Norwich, England. 1987. 297p. Edited by John Handmer.

Descriptors: *Flood plain management, *Flood control, *Flood protection, *Flood insurance, *Great Britain, Flood damage, Land use, Cost analysis, Risks, Flood forecasting, Flood plain zoning, Project planning, flood routing, Social aspects, Urban planning.

This volume is the product of research and policy development activity at the Middlesex Polytechnic Flood Hazard Research Center in England. A rioto razatu keseatch center in Enjanu. A small workshop was organized by the Center to discuss the details and implications of flood-related research both in Great Britain and internationally. Papers from the workshop were organized into the present volume in six sections: the British urban flood hazard; flood related institutions and policy in Britain; addresses the implementation of land use policy both locally and internationally; hazard responses with short lead times; project appraisal and risk assessment; and an overview of lessons in flood hazard management for Great Britain. (See W89-02744 thru W89-02758) (Geiger-PTT)

FLOOD PROBLEM IN PERSPECTIVE.

Middlesex Polytechnic, London (England). Flood Hazard Research Centre. J. W. Handmer.

IN: Flood Hazard Management: British and International Perspectives. Geo Books, Norwich, England. 1987. p 9-32, 8 tab, 49 ref, append.

Descriptors: *Flood plain management, *Flood control, *Flood damage, *Great Britain, Comparison studies, Australia, Wales, Urban areas, Management planning, Project planning, Flood forecasting, Flood plain zoning, Risks.

The British urban flood problem is not as severe as that of the United States or Australia. Response to flooding in Great Britain has been largely in terms of structural works rather than location control, especially along coastal settlements. The British historically have subsidized, to a great extent, protective structures through government funding and incentives. However, flood response has not been solely in structural terms. Apart from flood forecasting, there is a national system of development

control. The relatively limited extent of the urban flood hazard in England and Wales and the apparent success of riverine flood protection should not be allowed to obscure the fact that a substantial number of people could be inundated by extreme events. The hazard is increased by the very short flood lead times available, the absence of formal warning for about 40% of unprotected structures, and a number of recent failures of the sea flooding warning exprise. The loant term geometric to and a number of recent failures of the sea flooding warning services. The long term geomorphic processes in the south-east of England, cliff erosion, and land subsidence, will continue to exacerbate the situation. Britain's water industry, which has been reorganized from a public service to the business sector, must convert from a construction to a management mentality in order to achieve cost-effective and affordable solutions to flood hazard management. (See also W89-02743) (Author's abstract) thor's abstract)

INSTITUTIONAL AND POLICY CONTEXT, Middless Polytechnic, London (England). Flood Hazard Research Centre. For primary bibliographic entry see Field 6F. W89-02745

URBAN FLOOD PROBLEMS: THEIR SCALE AND THE POLICY RESPONSE, Ministry of Agriculture, Fisheries and Food, London (England).

I R. Whittle

IN: Flood Hazard Management: British and International Perspectives. Geo Books, Norwich, England. 1987. p 53-59, 1 fig, 2 ref.

Descriptors: *Urban planning, *Flooding, *Flood plain management, *Flood plain zoning, *Flood control, Management planning, Great Britain, Policy making, England, Wales, Flood damage, Project planning.

During the industrialization of Great Britain, set-tlements were established along flood plains to allow easy access to water for power. Recreational centers relied on shore areas which were also subject to flooding. The 1930 Land Drainage Act in Great Britain set up Catchment Boards and was the basis for the Land Drainage Act of 1976. The 1976 Act provided drainage authorities and coun-cils with the power to undertake works to protect against flooding and, in England, for the Ministry of Agriculture, Fisheries and Food to grant aid, or subsidize the cost of the works from central gov-ernment funds. Comparable arrangements exist in Wales where the grant aid system is administered by the Welsh Office Agriculture Department. Neither the Ministry nor drainage authorities have ever agreed to adopt uniform policies for standards ever agreed to adopt uniform policies for standards of flood protection. Flood warning system designs take into consideration poor response when dealing with populations already protected by structural works. As part of the design of flood alleviation schemes all their likely impacts, including environmental ones, should be assessed comprehensively. Although the need for policies controlling flood-plain development have for years been recognized, steps taken by the central government have been limited to issuing guidelines to local planning austeps taken by the central government have been limited to issuing guidelines to local planning authorities. Water Authorities have the obligation to identify floodplains and inform planning departments of areas liable to flooding. (See also W89-02743) (Geiger-PTT) W89_02746

DEVELOPMENT CONTROL PROCEDURES IN ENGLAND AND WALES, Wessex Water Authority, Poole (England).

For primary bibliographic entry see Field 6F. W89-02748

CONFLICTING OBJECTIVES IN FLOOD-PLAIN MANAGEMENT: FLOOD DAMAGE REDUCTION VERSUS HERITAGE PRESER-

Waterloo Univ. (Ontario). Dept. of Geography. For primary bibliographic entry see Field 6F.

DESIGN STANDARDS FOR BUILDING IN FLOOD HAZARD AREAS: A CRITICAL LOOK AT US EXPERIENCE AND POSSIBLE APPLICATIONS ABROAD,

Kusler (J. A.) Associates, Chester, VT.

IN: Flood Hazard Management: British and International Perspectives. Geo Books, Norwich, England. 1987. p 135-142, 18 ref.

Descriptors: *Flood plain management, *Flood plain zoning, *Flood control, *Urban planning, Great Britain, Flood damage, Floodproofing, Management planning, Design criteria, Flood insurance, United States, Comparison studies, Perfor-

An estimated 100,000 to 150,000 new structures are constructed in flood hazard areas in the United States each year consistent with performance-oriented design standards adopted at federal, state and local levels. These standards are designed to protect the flood conveyance capacity of rivers and require that structures be protected to or above the 100-year flood elevation. Detailed studies have not been conducted to evaluate the effectiveness of alternative designs in reducing losses. Preliminary studies, however, indicate that elevation on fill and pilings is more effective than structural floodproofing and highly cost-effective in many circumstances. Although considerable flood loss reduction is being achieved, flood management approaches in the United States have not adequately considered special conditions (e.g., velocity), have not substantially reduced loss to infrastructure, and have not adequately addressed stormwater management and drainage problems. More testing of approaches through post-flood field studies and refinements in standards are needed. Much of what is being learned in the United States may be applicable in Britain and elsewhere (subject to tailoring to local conditions). International co-operation in determining the effectiveness of alternative design approaches would be profitable. (See also W89-02743) (Author's abstract) An estimated 100,000 to 150,000 new structures are

FLOOD LOSS REDUCTION BY METROPOLITAN REGIONAL AUTHORITIES IN THE

Massachusetts Univ., Amherst. Dept. of Geology and Geography.
For primary bibliographic entry see Field 6E.
W89-02752

FLOOD WARNING DISSEMINATION: THE BRITISH EXPERIENCE,
Middlesex Polytechnic, London (England). Flood

Hazard Research Centre.
For primary bibliographic entry see Field 6F.
W89-02753

TARNING DISSEMINATION AND RE-SPONSE WITH SHORT LEAD TIMES, Colorado Univ. at Colorado Springs. Dept. of Geography and Environmental Studies. For primary bibliographic entry see Field 6F. W89-02754

FLOODPLAIN MAPPING AND BEYOND: A

STATE PERSPECTIVE,
Maryland Water Resources Administration, Annapolis. Flood Management Div.
For primary bibliographic entry see Field 6F.
W89-02755

SOCIAL CHOICE AND BENEFIT-COST ANAL-YSIS, Middlesex Polytechnic, London (England). Flood

For primary bibliographic entry see Field 6B. W89-02756 Hazard Research Centre.

ASSESSING THE HEALTH EFFECTS OF Greater London Council (England). Dept. of

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A-Control Of Water On The Surface

Public Health Engineering. For primary bibliographic entry see Field 2E. W89-02757

PROJECT APPRAISAL, RESOURCE ALLOCA-TION AND PUBLIC INVOLVEMENT, Bayerisches Landesamt fuer Wasserwirtschaft, Munich (Germany, F.R.). For primary bibliographic entry see Field 6E. W89-02758

WATERTOWN, MINNESOTA: FL PROOFING INFORMATION. Army Engineer District, St. Paul, MN. For primary bibliographic entry see Field 6F. W89-02939 FLOOD

CONSERVATION OF SOUTH AFRICAN RIVERS, Council for Scientific and Industrial Research, Pretoria (South Africa). Foundation for Research Development. For primary bibliographic entry see Field 2H. W89-02985

CONSERVATION AIMS, CRITERIA, AND GOALS FOR RIVERS, Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies. For primary bibliographic entry see Field 2H. W89-02987

CONSERVATION MANAGEMENT OPTIONS FOR RIVERS,
Transvaal Afdeling Natuurbewaring, Pretoria (South Africa). Professional Pr

TUNNEL AND RESERVOIR PLAN SOLUTION TO CHICAGO'S COMBINED SEWER OVER-FLOW, BASEMENT FLOODING, AND POLLU-TION, Metropolitan Sanitary District of Greater Chicago,

N. A. Bergman, and D. H. Kapadia. Canadian Journal of Civil Engineering CJCEB8, Vol. 15, No. 3, p 389-396, June 1988. 8 fig, 1 tab.

Descriptors: *Sewer systems, *Wastewater pollu-tion, *Wastewater outfall, Tunneling, Reservoirs, Flooding, Drinking water, Water quality, Tunnel and Reservoir Plan, Chicago.

In 1890, the Metropolitan Sanitary District of Greater Chicago was formed to permanently pro-tect the region's drinking water supply from devas-tating contamination by sewage. The solution was to excavate a massive canal across the continental to excavate a massive canal across the continental divide and to thus reverse the flow of the Chicago River, causing it to flow into the tributaries of the Mississippi River and away from Lake Michigan. Later, sewage treatment works were constructed to treat dry weather flows. Each time rainfall exceeds 8.4 mm, the combined sewers' capacities are exceeded, and they discharge directly to the canal system on the average of 100 times per year without benefit of treatment. When the sewers and without benefit of treatment. When the sewers and canal system are overtaxed, raw sewage backs up the sewers in Chicago and 51 suburbs, flooding streets, businesses, and home basements. In order to solve these problems on a regional basis, the Sanitary District in 1972 adopted the tunnel and reservoir plan (TARP). TARP is second river system which is being constructed by boring tunnels up to 11 m in diameter in rock as much as 100 m under the city. When the surface sewers' capacities are exceeded, the excess flows will drop into m unuer the city. When the surface sewers' capacities are exceeded, the excess flows will drop into TARP. Huge reservoirs totaling 157 million cu m capacity will store the sewage until it can be gradually pumped backed to the treatment works. (Author's abstract) W89-03134

MATHEMATICAL HYDRAULIC MODEL OF THE RIVER NENE -- A CANALIZED, AND HEAVILY CONTROLLED RIVER,

Queen Mary Coll., London (England). Dept. of

Queen Mary Coll., London (Engiand). Dept. of Civil Engineering. J. J. R. Williams, and N. P. Fawthrop. Regulated Rivers - Research and Management RRMEP, Vol. 2, No.4, p 517-533, September-Oc-tober 1988. 9 fig. 1 tab, 10 ref.

Descriptors: *Model studies, *Rivers, *Mathematical models, *Hydraulic models, *Flood control, *Water management, Flood routing, England, Regulated rivers

A mathematical hydraulic model of the Nene River in East Anglia, England is described. This river, which is typical of many in that predomi-nantly flat region, is canalized and subsequently heavily controlled. The routing model was devel-oped to investigate the effect of improvements that could be made to the river to reduce the frequency could be made to the river to reduce the frequency of flooding, the model is in its final stage of development. Results are presented of a flood that was monitored in March 1982. Encouraging results were obtained from runs simulating the flood event of 5-10 March 1982. The model proved capable of representing the complexities of this heavily controlled river. (Author's abstract) W89-03141

EFFECT OF IMPOUNDMENT ON THE GROWTH OF BAGRUS DOCMAC IN LAKE NASSER, Menoufia Univ., Shibin al-Kom (Egypt). Dept. of Zoology.
For primary bibliographic entry see Field 6G.
W89-03143

HISTORICAL BASIS FOR LIMITS ON LAKE SUPERIOR WATER LEVEL REGULATIONS. National Oceanic and Atmospheric Administra-tion, Ann Arbor, MI. Great Lakes Environmental Research Lab. H. C. Hartmann.

Journal of Great Lakes Research JGLRDE, Vol. 14, No. 3, p 316-324, 1988. 5 tab, 27 ref.

Descriptors: *Regulations, *International law, *Water level, *Lake Great Lakes, Superior, *History, International commissions, Water level fluc-

The 1979 International Joint Commission (IJC) Supplementary Orders of Approval for the regulation of Lake Superior outflows call for maintaining Lake Superior water levels below an elevation of 183.49 m above the International Great Lakes datum of 1955 (IGLD55). When Lake Superior rose above 183.49 m (IGLD55) in 1985, the IJC ordered discharges in excess of the operational regulation plan outflows. Continued pressure to reduce high water levels on the lower Great Lakes by storing water in Lake Superior calls into question the sanctity of the 183.49 m (IGLD55) limit. Based on IJC hearings and historical water level records, the present limit appears to be equivalent to the upper limit specified in the original 1914 Orders of Approval, when the latter is adjusted for differential isostatic rebound. However, testimony The 1979 International Joint Commission (IJC) Orders of Approval, when the latter is adjusted for differential isostatic rebound. However, testimony reveals that the IJC of 1914 expected levels to exceed the limit by about 0.15 m during water supply conditions similar to those of 1869 and 1876, which were matched in 1985. Although the expected exceedance of the 1914 limit appears to be based on an inaccurate maximum water level record, other historical records substantiate that Lake Superior should be expected to rise above 183.49 m (IGLD55) during times of high water supplies, such as 1985. (Author's abstract) W89-03173

MODEL FOR PREDICTING THE EFFECT OF DRAINAGE ON SOIL MOISTURE, SOIL TEM-PERATURE AND CROP YIELD, Helsinki Univ. of Technology, Espoo (Finland). Lab. of Hydrology and Water Resources Engi-pending.

neering.

T. Karyonen Natvonen.
 Available from the National Technical Information Service, Springfield, VA 22161, as PB88-1711343.
 Price codes: E09 in paper copy, E09 in microfiche.
 January 1988. 215p, 94 fig, 17 tab, 137 ref. Descriptors: *Model studies, *Drainage, *Soil water, *Soil temperature, *Crop yield, Permeability coefficient, Groundwater movement, Pipes, Hydraulic models, Water conveyance, Costs, Agri-

A methodology was developed that combines climatological data, soil properties, crop drainage requirements and drainage theory into a design method called water management model. The aim of this type of approach is to characterize the effect of drainage on soil moisture, soil temperature and crop yield. The final result of the application of these methods is a decision on optimum drainage parameters, i.e., drain spacing and depth, and drainage coefficient. Determination of the soil water retention curve, the unsaturated hydraulic and drainage coefficient. Determination of the soil water retention curve, the unsaturated hydraulic conductivity function and the soil thermal conductivity is discussed. Methods for describing the movement of water and heat in a seasonally frozen soil are presented. A model for estimating the effect of soil moisture on crop yield is described. When tested by comparisons with analytical solutions, laboratory data and field experiments, the results were favorable. It was shown that the methods presented here can be used in estimating the results were favorable. It was shown that the methods presented here can be used in estimating the proper drainage coefficient, i.e., the design flow that the pipe system must be capable of conveying. According to the results obtained, decreasing the design flow would reduce the total costs of the drainage system by 1-5%. Another practical result indicated that the optimum drain spacing is not only dependent on the soil type and crop grown; the choice is also affected by the time period used in the economic analysis and by the overall maximum yield level, which is an indication of the efficiency of the cultivation techniques used on the farm. (Author's abstract)

4B. Groundwater Management

PROCEEDINGS OF THE FOCUS CONFERENCE ON SOUTHWESTERN GROUND WATER ISSUES, For primary bibliographic entry see Field 2F. W89-02331

USE OF A REGIONAL GROUND-WATER FLOW MODEL FOR WATER RIGHTS ADMINISTRATION IN A SOUTHWEST ALLUVIAL

BASIN,
New Mexico State Engineer Office, Santa Fe.
D. L. Hathaway.
IN: Proceedings of the FOCUS Conference on
Southwestern Ground Water Issues. National
Water Well Association, Dublin, OH. 1988. p 3-14,

Descriptors: *New Mexico, *Groundwater move-ment, *Mimbres Basin, *Water rights, *Model studies, *Groundwater management, *Water re-sources development, *Water law, Finite element method, Mathematical studies, Statistical methods, Aquifers, Simulation, Geohydrology, Prediction, Hydrology, Water level fluctuations, Groundwat-er, Water supply systems er, Water supply systems

Water rights in the Mimbres Basin, an alluvial basin in southwestern New Mexico, are adminis-tered by the New Mexico State Engineer. In evalutered by the New Mexico State Engineer. In evaluating applications to appropriate groundwater, the state engineer is required by statute to consider the availability of supply and the effect of proposed appropriations on existing groundwater and surface water rights. A numerical groundwater flow model of the Mimbres Basin has been developed and is used routinely to provide this information. The Mimbres Basin model is a two-dimensional finite difference model capable of handling aquifer boundaries and beteroeneities. Future drawdown boundaries and heterogeneities. Future drawdown due to continued pumping by all existing users has been simulated with the model and the projected depth to water and average annual water level decline rate for each four-square-mile cell within decime rate for each four-square-mile cell within the modeled area has been determined. When a new appropriation is proposed, the model is run to simulate the incremental drawdown which would occur from the proposed pumping. These effects are then superimposed on current projected draw-

WATER QUANTITY MANAGEMENT AND CONTROL-

Groundwater Management—Group 4B

down and decline rates to obtain cumulative values. A cell-by-cell inventory of water level information is thus generated which, along with results of other hydrologic analyses, is used as a basis for decisions on water rights applications. (See also W89-02331) (Author's abstract) W89-02332

ASSESSMENT OF THE ADEQUACY OF THE GROUND-WATER MONITORING SYSTEM FOR ARTIFICIAL RECHARGE OF AQUIFERS IN THE LOS ANGELES AREA, CALIFORNIA, Western Water Consultants, Inc., Laramie, WY. For primary bibliographic entry see Field 7A. W89-02335

IMPACTS OF RECHARGE LEGISLATION ON GROUNDWATER MANAGEMENT IN ARIZO-

NA,
Arizona Dept. of Environmental Quality, Phoenix.
J. DuBois, K. Mitchell, and D. Daniel.
IN: Proceedings of the FOCUS Conference on
Southwestern Ground Water Issues. National
Water Well Association, Dublin, OH. 1988. p 7179, 12 ref.

Descriptors: *Legislation, *Arizona, *Artificial re-charge, *Groundwater management, *Water law, *Water quality control, *Water resources develop-ment, Aquifers, Geohydrology, Hydrology, Wastewater disposal, Political aspects, Ground-water monitoring, Water pollution sources, Water pollution control.

pollution control.

Artificial recharge of groundwater is recognized as an effective tool in managing water supplies in the arid Southwest. Through artificial recharge excess surface waters and treated wastewaters can be stored for later use. Despite strict conservation requirements of Arizona Groundwater Code, the application of recharge has been limited because of lack of an institutional framework. In 1986, Arizona enacted two laws which provide the necessary framework to implement recharge. The first law provided for the issuance of Recharge and Underground Storage and Recovery (USR) Permits by the Department of Water Resources. USR permits provide incentive for recharge since the water stored and subsequently withdrawn is not counted against the conservation requirements. The second law requires recharge or USR projects to obtain a permit from the Department of Environmental Quality to assure that Aquifer Water Quality Standards are not violated. Currently eighteen projects are in various stages of development, Standards are not violated. Currently eighteen projects are in various stages of development, ranging in size from 2 to 200,000 acre-feet per year. Sources of water for these projects include the Colorado River, wastewater treatment effluent, surface water from reservoirs, stormwater runoff, and drinking water from public supply. Maximizing water quantity without adversely affecting its quality presents a challenge for our state. Arizona's two water agencies are working together to help two water agencies are working together to help meet this challenge. (See also W89-02331) (Author's abstract) W89-02336

TRANSITION FROM GROUND-WATER MINING TO INDUCED RECHARGE IN GENERALIZED HYDROGEOLOGIC SYSTEMS, Leggette, Brashears and Graham, Inc., Albuquerque, NM.

que, NM.

W. P. Balleau, and A. B. Mayer.

IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 81-103, 10 fig, 3 tab, 28 ref.

Descriptors: *Water rights, *Artificial recharge, *Groundwater management, *Aquifers, *Model studies, *Geohydrology, Water resources development, Hydrology, Simulation, Water law.

The water rights system of prior appropriation can The water rights system of prior appropriation can be extended to groundwater by recognizing two components of the groundwater account: stored groundwater and induced recharge of surface water. Groundwater storage provides a transient source of water which gradually converts to surface-water depletion. The timing of the transition

to reliance on induced recharge of surface water is highly variable from case to case. The shape of the transition curve is calculated for five examples of highly variable from case to case. The shape of the transition curve is calculated for five examples of generalized aquifer types using the three-dimensional model program of McDonald and Harbaugh. The five example aquifer types are similar to those originally described by Lohman and include a perennial stream, an ephemeral stream, a closed basin, an extensive Tertiary aquifer, and an artesian basin. Few groundwater developments could be treated either as solely a mining or as a fully-recharged case during reasonable planning horizons. The ultimate limit on groundwater withdrawal is controlled by the magnitude of the surface water supply in the area of influence of the development and by the vertical permeability of the aquifer. For a particular wellfield layout, the limit on development is equal to the yield of the induced-recharge phase of the transition curve. This phase applies at times ranging from years to millennia depending on the geometry and diffusivity of the aquifer. The impacts on water rights depend on these factors and should be simulated for an explicit location, rate, and planning horizon. (See also W89-02331) (Author's abstract) W89-02331) (Author's abstract)

DRY WELLS - SOLUTION OR POLLUTION: AN ARIZONA STATUS REPORT, Arizona Dept. of Environmental Quality, Phoenix. For primary bibliographic entry see Field 5B. W89-02338

SIMULATING UNDERGROUND MINES IN A REGIONAL MODEL, Schreuder and Davis, Inc., Tampa, FL. For primary bibliographic entry see Field 4C. W89-02339

QUANTITY AND QUALITY OF RECHARGE TO THE OGALLALA AQUIFER FROM URBAN

Brandes (R.J.) Co., Austin, TX. For primary bibliographic entry see Field 4C. W89-02340

ROLE OF AQUIFER TESTING IN DESIGN OF CONSTANT-HEAD EXTRACTION SYSTEMS, Pacific Environmental Group, Inc., Santa Clara,

For primary bibliographic entry see Field 7B.

RECOVERY OF MOISTURE/SOLUTE PRO-FILES IN RECLAIMED COAL-MINE SPOIL, NORTHWEST NEW MEXICO. New Mexico Bureau of Mines and Mineral Re-

sources, Socorro. For primary bibliographic entry see Field 2F. W89-02360

HYDROGEOLOGICAL MAPPING IN ASIA AND THE PACIFIC REGION. For primary bibliographic entry see Field 7B. W89-02364

ASSESSMENT AND MAPPING OF AUSTRA-LIA'S GROUNDWATER RESOURCES, Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). For primary bibliographic entry see Field 2F. W89-02365

HYDROGEOLOGICAL MAPPING IN FIJL Department of Mineral Resources, Suva (Fiji). For primary bibliographic entry see Field 2F.

POSITION PAPER: SOLOMON ISLANDS, Ministry of Lands, Energy and Natural Resources, Honiara (Solomon Islands). For primary bibliographic entry see Field 2F. W89-02367

HYDROGEOLOGICAL DEVELOPMENT IN

HYDROGEOLOGICAL DEVELOPMENT IN VANUATU, Department of Geology, Mines, and Rural Water Supplies, Vila (Vanuatu). For primary bibliographic entry see Field 2F. W89-02368

DEVELOPMENT AND ACHIEVEMENTS OF HYDROGEOLOGICAL MAPPING IN CHINA, Ministry of Geology and Minerals, Beijing (China). Advisory Committee on Geology Science and Technology. For primary bibliographic entry see Field 2F. W89-02370

GROUNDWATER IN CHINA, Zhengding Inst. of Hydrogeology and Engineering Geology (China). For primary bibliographic entry see Field 2F. W89-0237

GROUNDWATER RESOURCES DEVELOP-MENT AND MANAGEMENT IN INDIA, Central Ground Water Board, New Delhi (India). For primary bibliographic entry see Field 2F W89-02373

STATUS OF HYDROGEOLOGICAL MAPPING IN INDONESIA IN 1983, For primary bibliographic entry see Field 7B. W89-02375

REVIEW OF GROUNDWATER IN THE RE-PUBLIC OF KOREA, Korean Inst. of Energy and Resources, Seoul (Republic of Korea). Applied Geology Div. For primary bibliographic entry see Field 2F. W89-02376

STATUS OF HYDROGEOLOGICAL MAPPING IN PENINSULAR MALAYSIA, Geological Survey of Malaysia, Ipoh. Hydrogeo-logy Div. For primary bibliographic entry see Field 2F. W89-02377

NOTES ON THE HYDROGEOLOGICAL MAP OF SARAWAK, Geological Survey of Malaysia, Kuching. Hydrogeology Section.
For primary bibliographic entry see Field 2F.
W89-02378

WATER RESOURCES AND HYDROGEOLOGI-CAL MAPPING IN THE MONGOLIAN PEO-PLE'S REPUBLIC Ministry of Water Economy, Ulan Bator (Mongo-For primary bibliographic entry see Field 2F.

W89-02379

HYDROGEOLOGY OF THE BUTWAL-BHAIR-AHWA AREA, LUMBINI ZONE, NEPAL, Department of Mines and Geology, Kathmandu (Nepal). For primary bibliographic entry see Field 2F. W89-02380

PAKISTAN-STATUS REPORT, Pakistan Water and Power Development Author-ity, Lahore. S. R. Ali.

IN: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p. 209-214, 1 fig.

Descriptors: "Hydrogeology, "Pakistan, "Mapping, "Groundwater, "Groundwater availability, "Surface water, "Surface-groundwater relations, 'Irrigation, Groundwater potential, Groundwater irrigation, Groundwater management, Groundwater management,

Field 4-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B-Groundwater Management

er mining, Groundwater movement, Water table fluctuations, Groundwater recharge.

fluctuations, Groundwater recharge.

Agriculture is the largest simple sector of Pakistan's economy, contributing about 36% of the gross domestic product. Water is the limiting factor of agricultural success, and the emphasis in planning has continued to be on the prudent exploitation of the water resources. The problems of trigated areas are ones of restricted drainage and unchecked seepage to aquifers resulting in the continuous rise of the water table creating waterlogging and salinity over vast tracts of agricultural lands. In other areas inadequate water supplies have become a serious impediment in the planning and programming of agricultural and industrial development. Three main regions in Pakistan have been identified as the basis of hydrogeological studies: (I) the mountainous north, (II) the vast flatlands traversed by river systems including the Indus Plain, and (III) the sub-mountainous regions of Baluchistan with its basin-and-range topography. A program of hydrogeological investigation that covers the entire canal-irrigated areas of the country is described. The purpose of the investigations was: to determine the distribution and extent of fresh groundwater zones and to assess the potential vield of groundwater for agricultural domesof fresh groundwater zones and to assess the poten-tial yield of groundwater for agricultural, domes-tic, and industrial use; to establish the feasibility of tic, and industrial use; to establish the feasibility of tube will drainage in areas where water table con-trol is essential; and to study the general geology and groundwater hydrology of the Indus basin. The results of the investigations and Indus basin. The results of the investigations and the hydrogeo-logical maps produced by them are presented. (See also W89-02364) (Davis-PTT) W89-02381

HYDROGEOLOGICAL MAPPING IN THE PHILIPPINES,
Bureau of Mines and Geo-Sciences, Manila (Philip-

Pines).
For primary bibliographic entry see Field 2F.
W89-02382

DEVELOPMENT OF GROUNDWATER RE-SOURCES IN SRI LANKA, National Water Supply and Drainage Board, Co-

National Water Supply and Drainage Board, Colombo (Sri Lanka).

A. G. N. Wijesekera.

IN: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p 221-230, 2 fig, 2 ref.

Descriptors: *Rock, *Sedimentary rock, *Aquifers, *Hydrogeology, *Sri Lanka, *Groundwater, *Groundwater availability, *Surface-groundwater relations, Groundwater potential, Groundwater irrigation, Groundwater management.

rigation, Groundwater management.

In Sri Lanka the groundwater resources are widespread throughout the country due to abundant rainfall. However, the varied geological, topographical, and climatic conditions on the island give rise to differing groundwater potentials. Of the total surface area, 90% is underlain by crystalline hard rock. Only recently, exploitation of groundwater in these hard rock areas was given priority. Many districts are presently being studied on a regional basis. The capacities of tube wells are adequate only for basic human consumption and small-scale agriculture. The remaining 10% of the island consists of deep sedimentary formations in the northern and northwestern coastal belt, where karst aquifers occur in Miocene limestone formations. Systematic exploration of these aquifers, with the aim of assessing their parameters and characteristics, and water balance studies will enable the preparation of hydrogeological maps. (See also W89-02364) (Author's abstract)

STATUS OF HYDROGEOLOGICAL MAPPING IN THAILAND,

Land Development Dept., Bangkok (Thailand). Soil Survey Div. For primary bibliographic entry see Field 2F. W89-02384

HYDROGEOLOGICAL MAPPING IN THE SO-CIALIST REPUBLIC OF VIETNAM.

N. D. Lam.
IN: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p. 247-250.

Descriptors: *Geology, *Vietnam, *Maps, Water resources development, Groundwater.

Hydrogeological mapping is being conducted with increasing intensity in the Socialist Republic of Vietnam with the aim of exploring groundwater, Vietnam with the aim of exploring groundwater, mineral water, and thermal water resources, thus benefitting the national economic planning. This task has been carried out during the last decade and extended, so that today it encompasses the whole country and has achieved a number of encouraging results. The Vietnamese hydrogeologists are seeking cooperation with the International Hydrogeological Society and similar associations from developed and developing countries, above all from countries within the Economic and Social Commission for Asia and the Pacific, with a view to exchanging experiences and mutual support. to exchanging experiences and mutual support. (See also W89-02364) (Author's abstract) W89-02385

SUMMARY OF WELL CONSTRUCTION, TESTING, AND PRELIMINARY FINDINGS FROM THE ALLIGATOR ALLEY TEST WELL, BROWARD COUNTY, FLORIDA, Geological Survey, Tallahassee, FL. Water Re-

Geological Staves, Sanctine Sources Div. F. W. Meyer. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-551, 1988. 68p, 11 fig, 7 tab, 39 ref.

Descriptors: *Artesian wells, *Injection wells, *Florida, *Floridan aquifer, Aquifers, Aquitards, Hydrogeology, Groundwater, Underground stor-*Artesian wells. *Injection wells.

A 2,811-foot deep test well was drilled during 1980 in The Everglades along Alligator Alley as part of the Floridan Regional Aquifer Systems Analysis project. The well was cased 895 feet deep. Hydraulic packers were used to isolate selected zones draulic packers were used to isolate selected zones in the open hole for water samples and measurement of water levels. The well penetrated the surficial and intermediate aquifers into the Floridan aquifer system. The top of the Floridan aquifer system occurs at 770 feet and includes limestone ranging in age from Oligocene to early Eocene. About 67 percent of the total thickness of the Floridan aquifer system was penetrated by the well. The chief water-producing zones in the Floridan aquifer system occur at about 1,030 feet and at about 2,560 feet. The 1,030-foot zone contains brackish artesian groundwater, and the 2,560-foot zone contains salty artesian groundwater similar in composition to seawater. The static water geothermal gradient is indicated, and radiocarbon activities suggest that the saltwater in the lower zone is ties suggest that the saltwater in the lower zone is younger than brackish groundwater in the upper zone. (USGS) W89-02465

GROUNDWATER LEVELS IN WYOMING, 1978 THROUGH SEPTEMBER 1987, Geological Survey, Cheyenne, WY. Water Re-

sources Div

Sources Div.
H. I. Kennedy, and S. L. Green.
Available from OFSS, USGS, Box 25425, Denver,
CO 80225. USGS Open-File Report 88-187, 1988.
132p, 15 fig, 19 tab, 10 ref.

Descriptors: *Hydrographs, *Wyoming, *Ground-water, *Observation wells, *Water level recorders, Data collections.

Groundwater levels are measured periodically in a network of 95 observation wells in Wyoming, mostly in areas where groundwater is used in large quantities for irrigation or municipal purposes. The program is conducted by the U.S. Geological Survey in cooperation with the Wyoming State Engineer and the Wyoming Economic Development and Stabilization Board. This report contains hydrographs for 95 observation wells showing water level fluctuations from 1978 through Senwater level fluctuations from 1978 through September 1987. Also included in the report are maps

showing locations of observation wells and tables listing well depths, use of water, geologic source, records available, and highest and lowest water levels for the period of record. (USGS) W89-02468

RECHARGE AS AUGMENTATION IN THE SOUTH PLATTE BASIN,

Colorado State Univ., Fort Collins. Dept. of Civil Engineering.

J. W. Warner, D. Sunada, and A. Hartwell. J. W. Warner, D. Sunada, and A. Hartwell. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-180435/ AS. Price codes A06 in paper copy; A01 in microfiche. Colorado Water Resources Research Institute, Fort Collins, Completion Report No. 144, September 1987. 116p. 10 fig., 10 tab, 12 ref, 3 append. Contract No. 14-08-0001-G1006. Project No. USGS G1006-22.

Descriptors: *Artificial recharge, *Return flow, *Groundwater recharge, *Surface-groundwater conjunctive management, *Augmentation plan, Basinwide water management, Colorado, South Platte River Basin.

Artificial recharge is a newly emerging technology for water management in the South Platte River Basin of Colorado. Currently there are about 44 recharge sites being operated, mostly for the purpose of augmenting streamflows. Augmentation is needed to offset the stream depletion caused by pumping from the alluvial aquifer in contact with the river. These augmentation/recharge projects have evolved from the quest for better basinwide water management in order to optimize the use of a limited water supply. Pilot recharge projects were first tried in the early 1960s. Some of the were recharge demonstrations and some were research sites. They are summarized in the report were first tried in the early 1960s. Some of the were recharge demonstrations and some were research sites. They are summarized in the report with brief descriptions of each project. These pilot projects proved the feasibility of artificial recharge in the South Platte Basin. More recently water supply organizations have begun to operate augmentation/recharge projects, often taking advantage of seepage from existing facilities such as canals and reservoirs. The report documents physical characteristics, water supplies and operating plans for existing recharge sites. The role of each site in an augmentation plan is described. The purpose of most of the artificial recharge sites it to produce return flow to the river for augmentation of river flow. The analytical method currently being used to calculate the timing and amount of return flow from a recharge site are evaluated. The two most popular methods are: (1) the Glover method; and (2) the Stream Depletion Factor method (sheed on the Glover method). Examples applications of each method are given and compared. The current laws and administrative rules which govern augmentation/recharge in the South Platte Basin are summarized. A typical plan for augmentation is documented in complete detail including the court decree (Fort Morgan Reservoir and Irrigation Company). (USGS)

RECORDS OF WELLS, DRILLERS' LOGS, WATER LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUNDWATER IN HARRIS AND GALVESTON COUNTIES,

Geological Survey, Houston, TX. Water Resources Div.

For primary bibliographic entry see Field 7C. W89-02497

ELECTED HYDROLOGIC DATA FOR PAH-VANT VALLEY AND ADJACENT AREAS, MIL-LARD COUNTY, UTAH, 1987,

Geological Survey, Denver, CO. For primary bibliographic entry see Field 7C. W89-02569

SELECTED GROUNDWATER INFORMATION FOR THE COLUMBIA PLATEAU REGIONAL AQUIFER SYSTEM, WASHINGTON AND

WATER QUANTITY MANAGEMENT AND CONTROL-Field 4

Groundwater Management—Group 4B

OREGON, 1982-1985: VOLUME I, GEOHYDRO-

LOGY, Geological Survey, Tacoma, WA. Water Resources Div. For primary bibliographic entry see Field 7C. W89-02572

SELECTED GROUNDWATER INFORMATION FOR THE COLUMBIA PLATEAU REGIONAL AQUIFER SYSTEM, WASHINGTON AND OREGON, 1982-1985: VOLUME II, WATER

Geological Survey, Tacoma, WA. Water Re-For primary bibliographic entry see Field 7C. W89-02573

GENERALIZED POTENTIOMETRIC SUR-FACE OF THE SPARTA-MEMPHIS AQUIFER, EASTERN ARKANSAS, SPRING 1980, Geological Survey, Little Rock, AR. Water Re-sources Div. For primary bibliographic entry see Field 7C. W89-02575

GROUNDWATER RESOURCES OF LIME-STONE COUNTY, TEXAS, Geological Survey, Austin, TX. Water Resources

For primary bibliographic entry see Field 2F. W89-02583

HYDROLOGIC ANALYSIS OF THE RIO GRANDE BASIN NORTH OF EMBUDO, NEW MEXICO, COLORADO AND NEW MEXICO, Creological Survey, Denver, CO. Water Resources

For primary bibliographic entry see Field 2F. W89-02589

SEASONAL CHANGES IN GROUNDWATER LEVELS IN THE SHALLOW AQUIFERS NEAR HAGERMAN AND THE PECOS RIVER, CHAVES COUNTY, NEW MEXICO, Geological Survey, Albuquerque, NM. Water Resources Div. H. S. Garn. Auxilable from OPSS USGS For 2014 P.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 88-197, 1988. 19p, 7 fig, 2 tab, 7 ref.

Descriptors: *Hydrologic data, *Alluvial aquifers, *Water table fluctuations, *New Mexico, Rosewell groundwater basin, Pecos River, Groundwater divide, Groundwater movement, Water table pro-

The Pecos River near Hagerman in Chaves County, New Mexico, historically has been a gaining stream. In 1938, the slope of the water table in the shallow alluvial aquifer near Hagerman was toward the Pecos River. By 1950, a large watertable depression had formed in the alluvial aquifer southwest of Hagerman. Continued enlargement of this depression could reverse the direction of groundwater flow to the Pecos River. Water levels were measured during 1981-85 in wells along a section extending from the Pecos River to a point within the depression. Although the water-table depression has not caused a perennial change in direction of groundwater flow, it has caused a seasonal reversal in the slope of the water table between the river and the depression during the growing season when pumpage from the shallow aquifer is the greatest. (USGS)

GEOPHYSICAL LOGS AND HYDROLOGICAL DATA FOR EIGHT WELLS IN THE COYOTE SPRING VALLEY AREA, CLARK AND LIN-COLN COUNTIES, NEVADA,

Geological Survey, Carson City, NV. Water Resources Div.

sources Div.
D. L. Berger, K. C. Kilroy, and D. H. Schaefer.
Available from OFSS, USGS, Box 25425, Denver,
CO 80225. USGS Open-File Report 87-679, 1988.
59p, 28 fig, 13 tab, 2 ref.

Descriptors: *Borehole geophysics, *Hydrologic data, *Carbonate aquifers, *Geochemistry, *Paleozoic carbonate-rock aquifers, *Nevada, Coyote Spring Valley area, Groundwater level, Pumping tests, Regional aquifer, Well drilling.

Geophysical logs, drilling operations, pump-test data, and water quality determinations are present-ed for eight wells in the Coyote Spring Valley area of southeastern Nevada. The wells are in an area where thick units of Paleozoic carbonate rock are where thick units of Paleozoic carbonate rock are overlain by Tertiary semiconsolidated basin-fill deposits and Quaternary alluvial deposits. Data collected by the U.S. Geological Survey were augmented with data from previous investigations; however, complete sets of logs and other data are not available for all eight wells. Geophysical data not available for all eight wells. Geophysical data presented included natural-gamma, neutron, gamma-gamma density, caliper, temperature, acoustic, single-point resistance, long- and short-natural resistivity, and spontaneous-potential logs. Drilling penetration rates, lithologic columns, and well construction are also summarized and presented. Measurements of drawdown and recovery during and after constant-discharge pumping periods are also included. Also presented are results of chemical and physical analyses for major-ion chemistry, trace constituents, stable and radioactive isotopes, temperature, pH, specific conductance, and dissolved oxygen. (USGS) W89-02603

LAND AND WATER MANAGEMENT ISSUES: TEXAS HIGH PLAINS, For primary bibliographic entry see Field 6D. W89-02634

CONJUNCTIVE USE OF SURFACE AND GROUND WATER IN THE SOUTH PLATTE, RIVER BASIN: A CASE STUDY OF THE CENTRAL COLORADO WATER CONSERVANCY DISTRICT,
Central Colorado Water Conservancy District,

ary bibliographic entry see Field 6D. For prima W89-02659

GROUND WATER RECHARGE FOR OKLA-HOMA: AN ANALYSIS OF PAST AND FUTURE METHODOLOGY, Oklahoma Water Resources Board, Oklahoma

City. R. K. Thomas

In: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p 57-72, 8 fig, 4 ref.

Descriptors: *Groundwater recharge, *Ground-water basins, *Artificial recharge, Water reuse, Oklahoma, Blaine Gypsum Project, Woodward Dam, Wells.

Of the six main aquifers in western Oklahoma, all but the Dog Creek Shale/Blaine Gypsum are showing a steady decline. This decline may be linked to irrigation, the major user of the available ground water. The land would quickly become hostile and impossible to farm without this water. Therefore, it is in the best interest of the state, its economy, and its people to instigate recharge projects. The parameters of artificial recharge are defined. Past recharge successes within the state are observed. New methods that may best demonstrate how to artificially recharge Oklahoma's aquifers are proposed. Methods of recharge vary with region and circumstances. No one method may be the primary instrument of recharge. Three possible methods are channel tail water or rain water into an area where it would percolate into the aquifer; use alluvium rather than the major aguifer for good quality water, or pump treated aquifer for good quality water; or pump treated effluent back down into the aquifer rather than allow it to flow away in a stream. (See also W89-02654) (Davis-PTT) W89-02660

SALINE SEEP ON WHEATLAND IN NORTH-WEST OKLAHOMA, Southern Plains Range Research Station, Wood-

ward, OK. For primary bibliographic entry see Field 5B. W89-02672

HYDROLOGY AND WATER QUALITY OF A DRAINED CLAY CATCHMENT, LOCKLE PARK, NORTHUMBERLAND,

Ministry of Agriculture, Fisheries and Food, Cambridge (England). Field Drainage Experimental Unit.

For primary bibliographic entry see Field 2E. W89.02880

GROUNDWATER FLOW THROUGH A MILIO-LITE LIMESTONE AQUIFER, Birmingham Univ. (England). Dept. of Civil Engi-

For primary bibliographic entry see Field 2F. W89-03050

INVESTIGATION INTO MECHANISMS OF MICROBIAL EFFECTS ON IRON AND MAN-GANESE TRANSFORMATIONS IN ARTIFI-CIALLY RECHARGED GROUNDWATER,

Zhengding Inst. of Hydrogeology and Engineering Geology (China).

R. Yan.
Water Science and Technology WSTED4, Vol.
20, No. 3, p 47-53, 1988. 3 fig, 7 tab.

Descriptors: *Groundwater recharge, *Artificial recharge, *Water quality, *Sulfur bacteria, Iron bacteria, Iron, Manganese, China, Recharging wells, Silting.

After artificial recharging of groundwater some problems occurred, including changes in groundwater quality and silting up of recharge (injection) wells. Therefore, the mechanisms of microbial effects on groundwater quality after artificial recharging were studied in Shanghai and the district of Changzhou. The source for groundwater recharge in Shangahai is purified water from the Shangai is purified water from the Shangai is purified water for the Huang-Pu River; treated wastewater from texile milks is used in Changzhou. These problems were annovached on treated wastewater from texile milks is used in Changzhou. These problems were approached on the basis of the amounts of biochemical reaction products generated by the metabolism of iron bacteria, sulfate-reducing bacteria, Thiobacillus thioparus, and Thiobacillus denitrificans. The experiments showed that in the transformations occurring and the siltation of recharge wells, microorganisms play an important role, due to the various chemical and biochemical activities. A water-rock-microorganisms system is proposed. (Author's abstract) stract) W89-03078

AQUIFER THERMAL ENERGY STORAGE IN FINLAND,

Vesi-Hydro, Helsinki (Finland) Water Science and Technology WSTED4, Vol. 20, No. 3, p 75-86, 1988. 9 fig, 3 ref.

Descriptors: *Artificial recharge, *Energy storage, *Thermal water, *Aquifers, *Groundwater, *Fin-land, Geothermal studies.

The rapid changes and crises in the field of energy during the 1970s and 1980s have forced us to examine the use of energy more critically and to look for new ideas. Seasonal aquifer thermal energy storage (T < 100 C) on a large scale is one of the gray areas which has not yet been extensively explored. However, projects are currently underway in a dozen countries. In Finland there have been three demonstration projects from 1974-1987. International cooperation under the auspices of the International Energy Agency, Annex VI, 'Environmental and Chemical Aspects of Thermal International cooperation under the auspices of the International Energy Agency, Annex VI, 'Environmental and Chemical Aspects of Thermal Energy Storage in Aquifers and Research and Development of Water Treatment Methods' started in 1987. The research being undertaken in 8 countries includes several elements fundamental to hydrochemistry and biochemistry. (Author's abstract) W89-03082

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B-Groundwater Management

MODEL FOR PREDICTING THE EFFECT OF DRAINAGE ON SOIL MOISTURE, SOIL TEM-PERATURE AND CROP YIELD, Helsinki Univ. of Technology, Espoo (Finland). Lab. of Hydrology and Water Resources Engi-page 1997.

neering.

For primary bibliographic entry see Field 4A. W89-03334

4C. Effects On Water Of Man's Non-Water Activities

SIMULATING UNDERGROUND MINES IN A REGIONAL MODEL, Schreuder and Davis, Inc., Tampa, FL.

Schreuder and Javis, inc., Tampa, F.L.

P. R. Davis, and T. A. Prickett.

IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 131-144, 7 fig. 1 ref.

Descriptors: *San Juan Basin, *Uranium mining, *Model studies, *Groundwater movement, *Groundwater management, *Aquifers, Regional analysis, Simulation, Prediction, Geohydrology, Hydrology, Mathematical studies, Statistical methods, Water level fluctuations, Groundwater, Finite element method.

A three-dimensional finite-difference numerical model of the 20,000 square-mile San Juan Basin was modified to simulate groundwater flow into underground uranium mines in the Westwater Canyon aquifer. Two different techniques were used, both based on the principle of variable-flow, constant-drawdown discharge from a node. For one technique, model grids were placed to approximate mine accordant and acuifer properties were one technique, mode grids were piacet to approx-imate mine geometry, and aquifer properties were adjusted accordingly. A more general technique using a variable-radius concept was used where insufficient data were available concerning mine geometry. The development and application of the two techniques are presented. Results are com-pared to historical data and to predictions made by other modeling techniques. A case study shows the interference effects in terms of water-level differences and changes in mine inflow (between sepa-rate mining areas) as predicted by the regional model simulating the aquifer in which the mines are located. (See also W89-02331) (Author's abstract) W80-02330

QUANTITY AND QUALITY OF RECHARGE TO THE OGALLALA AQUIFER FROM URBAN

TO THE OGALLALA AQUIFER FROM URBAN RUNOFF, Brandes (R.J.) Co., Austin, TX.
L. S. Stecher, and K. Rainwater.
IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 145-164, 7 fig, 3 tab, 12 ref.

Descriptors: *Urban hydrology, *Texas, *Ogallala aquifer, *Urban runoff, *Urban watersheds, *Groundwater recharge, *Model studies, Regional analysis, Water quality, Groundwater monitoring, Water pollution sources, Pollutant identification, Path of pollutants, Geohydrology, Hydrology, Aquifers, Groundwater, Water level fluctuations.

The groundwater in the Ogallala aquifer beneath the City of Lubbock, Texas, has been rising since 1965 due to increased recharge from playa lakes in the urbanized area. The recharge is sufficient to maintain a groundwater beneath the city despite the regional decline in the Ogallala water table maintain a groundwater description in the Ogallala water table around the city. Detailed water level measurements and numerical modeling have indicated that the average recharge rate is 7 to 11 thousand acrefeet per year. In some localized areas, a rapid rise of over twenty feet has occurred since 1982. Comprehensive water quality sampling has shown the chemical evolution of the recharged urban runoff as the water moves through the aquifer. This chemical evolution can be evaluated based on typical groundwater quality interactions. The data interactions are to the control of the restrictions. cal groundwater quality interactions. The data in-dicate minimal pollution by herbicides, pesticides

or heavy metals. (See also W89-02331) (Author's abstract) W89-02340

RECOVERY OF MOISTURE/SOLUTE PROFILES IN RECLAIMED COAL-MINE SPOIL, NORTHWEST NEW MEXICO, New Mexico Bureau of Mines and Mineral Re-

sources, Socorro.
For primary bibliographic entry see Field 2F.
W89-02360

MODELLING FLUVIAL PROCESSES IN STREAMS WITH GRAVEL MINING, San Diego State Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.

EFFECTS OF GEOLOGY, RUNOFF, AND LAND USE ON THE STABILITY OF THE WEST GALLATIN RIVER SYSTEM, GALLATIN COUNTY, MONTANA,

Montana State Univ., Bozeman. Dept. of Civil

Engineering.
D. R. Reichmuth.

D. R. Reichmuth.
Available from the National Technical Information
Service, Springfield, VA 22161, as PB88-228162.
Price codes: A05 in paper copy; A01 in microfiche.
Montana Water Resources Research Center
Report No. 134, Bozeman, June 1983. 71p, 50 fig, 7
tab, 11 ref, 4 append. Contract No. 14-34-00011128. Project No. OWRT A-088-MONT (1).

Descriptors: *Montana, *Gallatin River, *Forest management, *Stability, *Sediment transport, Ge-ology, River system, Bed load, Bridges, Earth-quakes, Fault, Hydrographs, Irrigation, Land use, Roads, Runoff, Land forms, Stream classification,

The West Gallatin River flows northward from its headwaters in Yellowstone Park. For the first fifty headwaters in Yellowstone Park. For the first fifty miles the river is confined in the narrow, rugged Gallatin Valley which is a broad, relatively flat alluvial valley. This study analyzes the behavior of the West Gallatin River in this lower section. It was found that the river has been changed considerably by geologically recent tectonic events such as earthquakes and isostatic shifting of large portions of the drainage area. During the past 100 years man has been activally altering elements of nons of the drainage area. During the past 100 years man has been actively altering elements of the drainage system. These alterations include forest management, irrigation, road construction, and housing development. Unfortunately many of these activities have been disruptive and have caused additional instabilities to develop in the system. This study described both the natural and the control of the system. man-induced changes which have occurred in terms of their system effect. It is hoped that a better understanding of the river's system behavior will lead to less adverse impacts when future activity in drainage is undertaken. (Peavy-MN St. U.)

COMPARISON OF CONCEPTUALLY BASED AND REGRESSION RAINFALL-RUNOFF MODELS, DENVER METROPOLITAN AREA, COLORADO, AND POTENTIAL APPLICATIONS IN URBAN AREAS, Geological Survey, Denver, CO. Water Resources Div.

J. B. Lindner-Lunsford, and S. R. Ellis.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 87-4104, 1987. 39p, 8 fig, 15 tab, 12 ref.

Descriptors: *Urban runoff, *Hydrologic models, *Model studies, Statistical models, Regression analysis, Peak flow, Runoff volumes.

Multievent, conceptually based models and a single-event, multiple linear-regression model for estimating storm-runoff quantity and quality from urban areas were calibrated and verified for four small (57 to 167 acres) basins in the Denver metropolitan area, Colorado. The basins represented dif-ferent land-use types - light commercial, single-family housing, and multi-family housing. Both

types of models were calibrated using the same data set for each basin. A comparison was made between the storm-runoff volume, peak flow, and between the storm-runoff volume, peak flow, and storm-runoff loads of seven water quality constituents simulated by each of the models by use of identical verification data sets. The models studied were the U.S. Geological Survey's Distributed Routing Rainfall-Runoff Model-Version II (DR3M-II) (a runoff-quantity model designed for urban areas), and a multievent urban runoff quality model (DR3M-QUAL). Water quality constituents modeled were chemical oxygen demand, total suspended solids, total nitrogen, total phosphorus, total lead, total manganese, and total zinc. (USGS) W89-02483

HYDROLOGY OF AREA 27, EASTERN REGION, INTERIOR COAL PROVINCE, ILLI-

Geological Survey, Urbana, IL. Water Resources Div.

For primary bibliographic entry see Field 5B. W89-02484

EFFECTS OF ORGANIC WASTES FROM PROCESSING OF GREEN RIVER FORMATION OIL SHALE ON WATER QUALITY, Geological Survey, Lakewood, CO. Water Resources Div. For primary bibliographic entry see Field 5B.

W89-02487 HYDROLOGY OF AREA 40, WESTERN REGION, INTERIOR COAL PROVINCE, KANSAS, OKLAHOMA AND MISSOURI,

Geological Survey, Lawrence, KS. Water Resources Div.

Sources Div.

M. V. Marcher, and J. F. Kenney.

Available from OFSS, USGS, Box 25425, Denver,
CO 80225. USGS Water Resources Investigations
Open-File Report 83-266, 1984. 131p, 42 fig, 4 tab,
147 ref.

Descriptors: *Coal mines, Stream discharge, Groundwater, Water quality, Kansas, Oklahoma, Missouri, Verdigris River, Neosho River, Spring

Coal Area 40 in the Western Region of the Interior Coal Province includes about 16,300 square miles in southeastern Kansas, southwestern Missouri, and northeastern Oklahoma. Rocks of Pennsylvanian age, which underlie about 80 percent of the area, contain nearly 1.8 billion tons of coal that can be contain nearly 1.8 billion tons of coal that can be strip mined under current economic conditions. The area is drained by the Verdigris, Neosha, and Spring Rivers. Streamflow data have been collected systematically at 166 stations; miscellaneous data have been collected at 335 sites. At least four determinations of specific conductance and pH have been made at 91 stream stations and 29 sta-tions each have more than 100 chemical analyses of stream water. Records of groundwater levels tions each have more than 100 chemical analyses of stream water. Records of groundwater levels are available for 438 wells and water quality data are available for 516 wells and springs. Maps, graphs, diagrams, and tables, accompanied by limited explanatory text, are used to summarize areal hydrology and the hydrologic effects of coal mining, petroleum production, and metal (zinc and lead) mining. In addition, the report includes sections of geology, soils, land use, climate, water use and water data sources. (USGS) W89-02488

SEDIMENT DISCHARGE DATA FOR THE LOWER REACH OF CAMPBELL CREEK, ANCHORAGE, ALASKA: MAY TO SEPTEMBER

Geological Survey, Anchorage, AK. Water Resources Div. For primary bibliographic entry see Field 2J. W89-02496

HYDROLOGY OF AREA 62, NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES-NEW MEXICO AND ARI-

WATER QUANTITY MANAGEMENT AND CONTROL-Field 4

Effects On Water Of Man's Non-Water Activities—Group 4C

Geological Survey, Albuquerque, NM. Water Re-For primary bibliographic entry see Field 2F. W89-02498

SELECTED HYDROGEOLOGIC DATA FOR THE SOUTHWEST GLENDIVE PRELIMI-NARY LOGICAL MINING UNIT AND ADJA-CENT AREAS, DAWSON COUNTY, MON-

Geological Survey, Honolulu, HI. Water Resources Div.

For primary bibliographic entry see Field 7C. W89-02531

U.S. GEOLOGICAL SURVEY URBAN-STORM-WATER DATA BASE OF CONSTITUENT STORM LOADS; CHARACTERISTICS OF RAINFALL, RUNOFF, AND ANTECEDENT CONDITIONS; AND BASIN CHARACTERIS-

Geological Survey, Denver, CO. Water Resources

For primary bibliographic entry see Field 7C. W89-02581

RAINFALL-RUNOFF DATA FOR SOMERSET

Geological Survey, Trenton, NJ. Water Resources

For primary bibliographic entry see Field 2E.

HYDROLOGY OF THE WHITE TAIL BUTTE AREA, NORTHERN CAMPBELL COUNTY, WYOMING,

Geological Survey, Cheyenne, WY. Water Resources Div.

Sources Div. M. E. Lowry, and J. G. Rankl. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 82-4117, 1987. 47p, 26 fig. 9 tab, 12 ref.

Descriptors: *Coal hydrology, *Rainfall-runoff re-lationships, *Coal mining impact, *Peak flow, *Surface-groundwater relations, *Wyoming, Rain-fall, Runoff, Hydrology, Reclamation, Groundwat-er, Water pollution sources, Groundwater pollu-tion, Campbell County.

Quantity of runoff and peak discharge from one small basin in the White Tail Butte area, deter-mined from a calibrated rainfall-runoff model, is less than the quantity computed using results of a regional study. The difference is caused by the extensive beds of exposed, permeable clinker in the area. Potentiometric surfaces in the White Tail area. Potentiometric surfaces in the White Tail Butte area indicate that, regionally, it is a discharge area. This is consistent with the conceptual model developed elsewhere in Campbell County, Wyo. The chemical quality of water from springs and alluvium, however, is characteristic of water found in recharge areas, so movement of water in the regional system is apparently small compared to local recharge. If surface coal mining occurs in the area, the principal adverse impact to the groundart system would be the destruction of springs. water system would be the destruction of springs and seeps in the mined area. These could be re-stored with special reclamation procedures. There are adequate quantities of water of suitable quality for stock or domestic use below the coal so postre-clamation sunnies could be obtained. Impacts of not suck or comestic use below the coal so postre-clamation supplies could be obtained. Impacts of surface mining on runoff could not be evaluated, but sensitivity of runoff to infiltration indicates a 10% change in runoff for a 1% change in infiltra-tion. (USGS)

HYDROLOGIC DATA FOR URBAN STUDIES IN THE AUSTIN METROPOLITAN AREA, TEXAS, 1986,

Geological Survey, Austin, TX. Water Resources

J. D. Gordon, D. L. Pate, and D. L. Slagle. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-768, 1988. 144p, 5 fig, 9 tab, 11 ref.

Descriptors: *Rainfall-runoff relationships, *Urban runoff, *Texas, *Data collections, *Austin, *Colorado River, Urban hydrology, Storm runoff, Streamflow, Hydrologic data, Balcones escarpment, Edwards aquifer.

This report contains rainfall and runoff collected during the 1986 water year for the Austin, Texas metropolitan area. In 1975, the program was expanded to include the collection of water quality data, and in 1978, to include a groundwater resources study of the south Austin metropolitan area in the Balcones Fault Zone. The information will be useful in determining the effect of urbanization of flood peaks, volume, and water quality. The major streams in the study area are Onion Creek, Barton Creek, Walnut Creek, Bull Creek, Boggy Creek, Shoal Creek, will was creek. All streams in the area are within the Colorado River basin. Rainfall-runoff computations are presented for seven storms producing rainfall over 3 inches during the 1986 water year. Water quality data for sites in the Austin metropolitan area are also given in this report. (USGS) This report contains rainfall and runoff collected

HYDROLOGY OF AREA 8, EASTERN COAL PROVINCE, WEST VIRGINIA AND OHIO, Geological Survey, Charleston, WV. Water Re-

F. A. Friel.

E. A. Friel. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 84-463, 1987. 78p, 55 fig, 19 tab, 76 ref.

Descriptors: *Rainfall-runoff relationships, *Sediment yield, *Water quality, *Coal mining, *Ohio River, *West Virginia, *Ohio, *Coal hydrology, Flood peak, Low flow, Sulfate, Iron, Manganese,

The hydrology of Area 8 in the Ohio River basin in northwestern West Virginia and southeastern in northwestern West Virginia and southeastern Ohio, is influenced by geology and geologic struc-ture. Rocks underlying the area consist of alternat-ing beds of sandstone, siltstone, shale, limestone, and mudstone. Minable coal is contained within the Pennsylvania and Permian rocks. Coal produc-tion in 1980 totaled 6.7 million tons from underground mines and one million tons from surface mines. There is a wide range of soil types (29 soil mines. There is a wide range of soil types (29 soil associations) in five land-resource areas. Precipitation averages about 41 inches annually and is greatest at higher altitudes along the eastern boundary of the area. Average annual runoff ranges from 13 to 29 inches per year. The principal land uses are forest and agriculture. Estimated water use during 1980 was 1,170 million gallons per day. Surfacewater quality ranges from excellent to poor. The highest iron, manganese and sulfate concentrations were present in mined areas. Well yields range mignest from, manganese and suitate concentrations were present in mined areas. Well yields range from less than 1 to 350 gallons per minute. Groundwater from the Mississippian rocks contain lesser amounts of dissolved solids than water from the Lower Pennsylvanian rocks. Water high in chloride content is present in some valley areas. W89_02598

SNOW WATCH '85.

Lamont-Doherty Geological Observatory, Palisades, NY. For primary bibliographic entry see Field 2C. W89-02606

EVALUATION OF RAIN CHEMISTRY DATA FOR THE JOHN F. KENNEDY SPACE CENTER, FLORIDA AND THE UNIVERSITY OF CENTRAL FLORIDA, ORLANDO, FLORI-DA.

University of Central Florida, Orlando. Dept. of

Chemistry.
B. C. Madsen, T. W. Dreschel, and C. R. Hinkle. Available from the National Technical Information Service, Springfield, VA. 22161, as N87-25635. Price codes: A03 in paper copy, A01 in microfiche. NASA Technical Memorandum 100301, October 1986. 18p, 3 fig, 6 tab, 22 ref. Descriptors: *Environmental effects, *Space Shut-tle, *Acid rain, *Water pollution sources, *Chemis-try of precipitation, Monitoring, Precipitation, Chemical analysis, Chlorine, Sodium, Magnesium, Hydrogen ion concentration, John F. Kennedy Space Center, Florida, Orlando.

Concern over the effects of Space Shuttle launches Concern over the effects of Space Shuttle launches prompted the initiation of a rather intense environ-mental monitoring program in July 1977. The pro-gram included a precipitation monitoring network with 13 precipitation collection sites which were operated for various time periods to baseline pre-cipitation chemistry at the John F. Kennedy Space Center (KSC). One additional site was also estabcipitation chemistry at the John F. Kennedy Space Center (KSC). One additional site was also established as a remote background site on the University of Central Florida (ÚCF) campus near Orlando, 30 miles west of KSC. Collections and analyses of samples were performed using a number of methodologies. An evaluation of the data for comparability and utility for acid rain research was performed using the anion/cation, measured conductivity/calculated conductivity, Cl/Na, and Mg/Na ratios. Data collected at all KSC sites between 1971 and 1981, from 1983 to 1985 at the NADP site and at UCF to 1985 are comparable and appropriate for determining acid rain trends. Examination of those comparable data showed a fairly stable pH between 1977 and 1982 and an increase of 0.2 pH units which was observed as an incremental increase between 1982 and 1983 at KSC and UCF. The pH has remained again stable for 1984 and 1985. There is no indication of any adverse impacts from Shuttle launches to rain chemistry. (Author's abstract)

CLAM SHELL DREDGING IN LAKES PONT-CHARTRAIN AND MAUREPAS, LOUISIANA, Army Engineer District, New Orleans, LA. For primar W89-02715 ary bibliographic entry see Field 6G.

EFFECTS ON SUSPENDED AND SUBSTRATE SEDIMENTS IN TWO STREAMS RESULTING FROM DIFFERENT GAS-PIPELINE INSTALLATION TECHNIQUES,

LATION TECHNIQUES, Argonne National Lab., IL. Biological, Environ-mental, and Medical Research Div. J. P. Schubert, and W. S. Vinikour. Available from the National Technical Information Service, Springfield, VA. 22161, as DE88-002877. Price codes: A03 in paper copy, A01 in microfiche. Report No. CONF-8710210—4, (1987). 12p, 10 fig, 1 tab, 24 ref. DOE Contract 5082-254-0690.

Descriptors: *Pipelines, *Construction projects, *Suspended solids, *Natural gas, *Environmental effects, Streams, Little Miami River, Particle size, Construction, Stream degradation, Environmental impact, Gas pipelines.

The effects of gas-pipeline construction projects on suspended solids (SS) and streambed sediments were investigated at two stream sites. The Little Miami River in Ohio was crossed using the wet-ditching technique. Concentrations of SS were elevated up to 400 m downstream during the two days of trenching operations, and fine sediment was deposited on the streambed up to 200 m downstream of the crossing. The SS decreased rapidly after trenching was completed, and the fine sediment was removed from the streambed by high stream flows two to eight months after construction. Canada Creek in Michigan was crossed using a plow method. The time duration of stream distion. Canada Creek in Michigan was crossed using a plow method. The time duration of stream disturbance was much less for the plow method, and the effects on suspended solids and streambed sedimentation were minimal. For both installation methods, the impacts were reversible, and no long-term impacts on the stream environments were detectable. (See also W89-02861) (Author's abstract) W89-02823

EFFECTS OF GAS-PIPELINE CONSTRUC-TION ON THE AQUATIC ECOSYSTEM OF CANADA CREEK, PRESQUE ISLE COUNTY, MICHIGAN,

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4C-Effects On Water Of Man's Non-Water Activities

Argonne National Lab., IL. Energy and Environ-

mental Systems Div. W. S. Vinikour, and J. P. Schubert.

W. S. Vinikour, and J. P. Schubert. Available from the National Technical Information Service, Springfield, VA. 22161, as PB88-183017. Price codes: A04 in paper copy, A01 in microfiche. Report No. GRI-87/0027, January 1987. Final Report (September 1984-July 1986). 82p, 19 fig, 11 tab, 78 ref. 2 append. Gas Research Institute Contract 5082-254-0690.

Descriptors: *Michigan, *Gas pipelines, *Environ-mental impact, *Pipelines, *Natural gas, *Environ-mental effects, Ecological effects, Biological stud-ies, Chemical properties, Physical properties, Sus-pended solids, Particle size, Macroinvertebrates, Fish, Population distribution, Streams, Canada Creek.

A study was conducted to quantify the effects of pipeline construction on the biological, physical, and chemical characteristics of Canada Creek in and chemical characteristics of Canada Čreek in Presque Isle County, Michigan. The plow method was used to install the pipeline. Shoreline ramp construction, rather than the actual installation of the pipeline by the plow, resulted in the greatest increases in suspended solids. During ramp excavation, suspended solids concentrations increased from < or = 50 mg/L to as high as 1105 mg/L three meters downstream from the crossing site during actual pipeline installation, suspended solids concentrations did not exceed 77 mg/L. Streambed particle size distribution was not appreciably concentrations did not exceed 17 mg/L. Stream-bed particle size distribution was not appreciably affected by excavation and installation activities, and no effects on water chemistry were detected. Additionally, no impacts on benthic macroinverte-brates or the prevalent fish species (American brook lamprey and mottled sculpin) occurred. Minor, short-term effects on macroinvertebrate Milior, short-term effects on macroinvertenate drift during ramp excavation were indicated by increased drift densities and diversities, as well as by the increased occurrence of terrestrial species. The short installation time required, in combination with the minimal amount of instream disturb ance caused by the plow, accounts for the lack of major installation impacts. (See also W89-02823) (Author's abstract) W89-02861

I-664 BRIDGE-TUNNEL STUDY, VIRGINIA SEDIMENTATION AND CIRCULATION IN-VESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.

S. J. HELIZEI.

Available from the National Technical Information Service, Springfield, VA. 22161. Technical Report HL_88-25, September 1988. Final Report. 56p, 19 flg, 3 tab, 14 ref, 12 plates.

Descriptors: *Estuaries, *Bridges, *Sedimentation, *Water circulation, *Virginia, *Tunnels, Flow ve-locity, Navigation channels, Model studies, James River, Hydraulic models, Numerical analysis.

Results from physical and numerical model tests on the effects of the proposed I-664 James River on the effects of the proposed I-664 James River Bridge-Tunnel complex on (a) sedimentation in the federally maintained channels (Newport News, Norfolk Harbor, and Elizabeth River), (b) general sedimentation in the lower James River, (c) changes in overall flushing characteristics, and (d) changes in current velocities and flushing near the Craney Island disposal site, are presented. The navigation channel sedimentation was evaluated using the TABS-2 finite element numerical models RMA-2V for hydrodynamics and STUDH for sedimentation with an existing numerical mesh of the Elizabeth River and lower James River areas. For the general sedimentation investigation, a new numerical mesh was created and the same numerical models, RMA-2V and STUDH, were used. numerical mesh was created and the same numerical models, RMA-2V and STUDH, were used. Data for the flushing and currents evaluation were provided by the Virginia Institute of Marine Science. Results from the physical model tests indicate circulation changes will be localized with minimal effects on the general circulation of the lower James River. Results from the numerical sedimentation modeling indicate that sedimentation will be generally unchanged or reduced except on either side of the north island where increases can be expected. The areas experiencing unchanged or

slightly reduced sedimentation rates include the oyster grounds, the Elizabeth River and Norfolk Harbor Channels, and the Newport News Chan-nel. (Author's abstract)

CAUSES OF WETLAND LOSS IN THE COAST-AL CENTRAL GULF OF MEXICO, VOLUME 2: TECHNICAL NARRATIVE.

ouisiana State Univ., Baton Rouge. Center for Wetland Resources.

Wetland Resources.

Available from the National Technical Information Service, Springfield, VA 22161, as PB88-20081.

Price codes: Al8 in paper copy, A01 in microfich.

OCS Study MMS 87-0120, January 1988. 400p, 168 fig, 102 tab, 266 ref. Edited by R. E. Turner, and D. R. Cahoon, Contract 14-12-0001-30252.

Descriptors: *Wetlands, *Water pollution effects, *Gulf of Mexico, Continental shelf, Subsidence, Sedimentation, Saline water intrusion, Coastal waters, Oil industry, Land developments, Coastal marshes. Coastal zone management

In 1985, the Minerals Management Service initiated an investigation to study the causes of wetland loss in the coastal Gulf of Mexico as part of its outer continental shelf (OCS) environmental studies program. The purpose of the two-year study was to investigate the factors that contribute to was to investigate the factors that contribute to wetland loss and to determine specifically what percentage of the loss is directly and indirectly related to Federal offshore oil and gas develop-ment. The primary goal of the Coastal Effects Program is to delineate the onshore impacts of offshore oil and gas development activities. The final report, prepared in three volumes, describes the extent of the contribution of OCS development to coastal land-loss. This report provides a detailed to coastal land-loss. This report provides a detailed description of both direct and indirect impacts, and provides an introduction to the study, direct impact of OCS activities, saltwater intrusion, subence and sedimentation, and landscape patterns and aerial imagery. (Author's abstract)

CAUSES OF WETLAND LOSS IN THE COAST-AL CENTRAL GULF OF MEXICO, VOLUME 3.

Louisiana State Univ., Baton Rouge. Coastal Ecology Lab.

Available from the National Technical Information Available from the National 1 echnical Information Service, Springfield, VA 22161, as PB88-200829. Price codes: A06 in paper copy, A01 in microfiche. OCS Study MMS 87-0120. 121p. Edited by R.E. Turner, and D. R. Cahoon. Contract 14-12-0001-

Descriptors: *Wetlands, *Coastal marshes, *Gulf of Mexico, *Environmental effects, Oil industry, Ecological effects, Land loss, Data collections, Continental shelf, Salinity.

In 1985, the Minerals Management Service initiated an investigation to study the causes of wetland loss in the coastal Gulf of Mexico as part of its outer continental shelf (OCS) environmental studies program. The purpose of the two-year study ies program. The purpose of the two-year study was to investigate the factors that contribute to wetland loss and to determine specifically what percentage of the loss is directly and indirectly related to Federal offshore oil and gas development. The primary goal of the Coastal Effects Program is to delineate the onshore impacts of offshore oil and gas development activities. The final report, prepared in three volumes, describes the extent of the contribution of OCS development occastal landloss. This report Volume III. conto coastal land-loss. This report, Volume III, contains five appendices providing methodological details and data listings. (Author's abstract)

CUMULATIVE IMPACT ASSESSMENT: ISSUES TO CONSIDER IN SELECTING A CUMULATIVE ASSESSMENT METHOD, Argonne National Lab., IL. Energy and Environ-

ital Systems Div. For primary bibliographic entry see Field 5C. W89-02965

EVALUATION OF BASELINE CONDITIONS AT LEASE TRACT C-A, RIO BLANCO COUNTY, COLORADO,

University of Wyoming Research Corp., Laramie. Western Research Inst. For primary bibliographic entry see Field 5B.

USES OF, AND HUMAN IMPACT ON RIVERS. USES OF, AND HUMAN IMPACT ON RIVERS, Natal Univ., Pietermaritzburg (South Africa). Dept. of Zoology. C. C. Appleton, J. Heeg, B. R. Davies, S. C. J. Joubert, and R. D. Walmsley. IN: Conservation of South African Rivers. 1986. p

24.35 19 ref

Descriptors: *Environmental effects, *Water pollu-tion effects, *South Africa, Urban areas, Agricul-ture, Sedimentation, Public health, River flow, Storm runoff, Industrial wastewater, Rural areas,

The inestimable value of rivers should be obvious The inestimable value of rivers should be obvious to all, yet the alarming degradation which they continuously suffer is testimony to the need for a brief statement of the main uses to which they are put and the consequences of thoughtless exploitation. These include agriculture (which causes abtraction, destruction of riparian vegetation, increased silt load, deterioration in water quality and spread of waterborne diseases), urban complexes (creating reduced river flow, stormwater drainage, sewage effluent, and urban refuse), population concentrations in rural areas, industry, and recreation. sewage effluent, and urban refuse), population con-centrations in rural areas, industry, and recreation. Sound conservation practices, based on current knowledge of river ecosystem functioning and re-inforced by the results of ongoing research into the applicability of this knowledge to all categories of South African river systems, holds benefits for all users. (See also W89-02985) (Lantz-PTT) W89-02988

HYDROGEOCHEMISTRY OF THE UPPER PART OF THE FORT UNION GROUP IN THE GASCOYNE LIGNITE STRIP-MINING AREA, NORTH DAKOTA,

R. L. Houghton, D. C. Thorstenson, D. W. Fisher, and G. H. Groenewold.

Available from Books and Open-File Reports Section, USGS, Box 25425, Denver, CO 80225, USGS Professional Paper 1304, 1987, 104p, 45 fig, 19 tab, 141 ref, 5 append.

Descriptors: *Geohydrology, *Geochemistry, *Lignite, *Strip mines, *North Dakota, Water quality, Aquifers, Confined aquifers, Groundwater recharge, Aeration zone, Precipitation, Model studies, Overburden, Land reclamation, Mine wastes, Sulfates, Sulfides, Groundwater recession.

The lignite aquifer in the Northern Great Plains lignite region is recharged mainly by local precipitation and discharges mainly to the underlying basal Bullion Creek-Slope aquifer, which is confined by the lignite underclay. Because recharge to both aquifers is dominated by precipitation, the quality of shallow ground waters is controlled mainly by chemical processes occurring in the unsaturated zone. Laboratory experiments and modeling indicate the controlling processes are: Dissolution of spoil gases generated by oxidation of iron sulfide minerals; dissolution of carbonate minerals; precipitation and dissolution of gypsum; cation exchange on clay minerals and cation ex-The lignite aquifer in the Northern Great Plains cation exchange on clay minerals and cation ex-change and adsorption on lignitic material in the unsaturated zone; and cation exchange, sulfate re-duction and calcite precipitation within the aquifer. Most of these reactions occur in the natural environment but are accelerated by mine disturbances. Because oxidation of reactable iron sulfides to sulbecause oxidation of reactable from sumices to surface salts proceeds to completion during the over-burden-stripping process itself, the effects of this process on aquifer water quality cannot be alleviat-ed by any reclamation activity. Selective replacement of near-surface overburden above the water table, however, can decrease the introduction of soluble salts into contributes and the processing activities. soluble salts into postmining aquifers. Dewatering of the lignite aquifer within the mine to facilitate stripping has produced a large cone of depression centered on the mine in the lignite aquifer and the

Identification Of Pollutants-Group 5A

underlying sandstone aquifer. Although the cone of depression extends only 2 to 3 miles beyond the mine boundaries, water levels in the lignite aquifer in the mine area have been declining at a rate of 2.5 ft per year. Parts of the lignite aquifer removed by mining are reestablished in the rubble zones at the base of the spoil piles. As compaction of the spoils occurs, the ability of the rubble zone to conduct water will decrease. Thus postmine water in the spoils may be expected to decrease in quantity and deteriorate in quality. (Author's abstract)

INDIRECT EFFECTS AND BIOLOGICAL CONTROL OF MOSQUITOES BY MOSQUITO-

California Univ., Santa Barbara. Dept. of Biological Sciences

For primary bibliographic entry see Field 2H. W89-03124

RESPONSE OF COASTAL PLANTS TO IN-CREASE IN SUBMERGENCE AND SALINITY, Louisiana State Univ., Baton Rouge. Lab. for Wet-land Soils and Sediments. For primary bibliographic entry see Field 2L. W89-03188

MODIFICATION AND ASSESSMENT OF AN INDEX OF BIOTIC INTEGRITY TO QUANTIFY STREAM QUALITY IN SOUTHERN ONTARIO,

Toronto Univ. (Ontario). Dept. of Zoology. R. J. Steedman

Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 3, p 492-501, March 1988. 4 fig, 6 tab, 33 ref.

Descriptors: *Stream biota, *Fish populations, *Species diversity, *Stream quality, *Bioindicators, *Land use, *Ontario, Urban watersheds, Forest watersheds, Biological properties, Model studies, Biomass, Streams, Biological samples, Sampling, Spatial distribution, Regression analysis.

A multivariate measure of stream quality, the Index of Biotic Integrity (IBI), was adapted to southern Ontario and calibrated to watershed land use on a variety of spatial scales. The fish fauna at 209 stream locations on 10 watersheds near Toron-to, Ontario, was sampled with a backpack electro-fisher in the summers of 1984 and 1985 to provide biological information for the IBI. Watershed urtisher in the summers of 1984 and 1985 to provide biological information for the IBI. Watershed urbanization, forest cover, and riparian forest were measured from 1:50,000 scale topographic maps and related to IBI estimates by linear regression. Of the biological measures tested, species richness, local indicator species (brook trout (Salvelinus fontinalis) and Rhinichthys spp.), abundance of large piscivores, fish abundance, and incidence of black-spot disease were found to contribute significantly to IBI estimates. Variation in IBI estimates at the same location ranged from 0 to 24% between years. Linear models based on measures of watershed urbanization and forest cover accounted for 11-78% of the variation in IBI scores, depending on the spatial scale of the analysis. Significant IBI/land use relationships were found with whole-basin IBI estimates and for IBI estimates from individual stream reaches. Land use immediately upstream of sample stations was most strongly associated with stream quality as measured by the IBI. (Author's abstract) abstract) W89-03211

ESTUARIES: CONCERN OVER TROUBLED

For primary bibliographic entry see Field 7A. W89-03279

4D. Watershed Protection

RIVER DYNAMICS, FLOW REGIME AND SEDIMENT TRANSPORT, University of East Anglia, Norwich (England). School of Environmental Sciences.

For primary bibliographic entry see Field 2J. W89-02432

RESERVOIR SEDIMENTATION AND INFLU-ENCE OF FLUSHING,

For primary bibliographic entry see Field 2J. W89-02457

PROBLEMS IN GRAVEL-BED RIVERS, ALASKA,

Harza Engineering Co., Chicago, IL. For primary bibliographic entry see Field 2J.

ANALYSIS OF BANK STABILITY IN THE DEC WATERSHEDS, MISSISSIPPI,

Queen Elizabeth Coll., London (England). C. R. Thorne.

Available from the National Technical Information Available from the National Technical Intornation Service, Springfield, VA 22161, as AD-A189 421. Price codes: A03 in paper copy, A01 in microfiche. First Periodic Report May-June 1987. Second Periodic Report July-October 1987. 28p, 9 fig, 2 tab, 8 ref, 5 append. European Research Office of the U.S. Army Contract No. DAJA45-87-C-0021.

Descriptors: *Bank stability, *Stream erosion, *Bank erosion, *Mississippi, *Stability analysis, Bank stabilization, Computer programs, Erosion,

The first periodic report contains a brief descrip-tion of start-up activities for a study of bank stabili-ty in Mississippi Bluff Line streams. A program was written for a calculator which prompts for the was written for a calculator which prompts for the required data, performs the analysis, and presents and interprets the results. A user's manual, which is included in an annex, gives instructions for the use of the program to calculate the safety factor for an existing bank and how to find the amounts of flow erosion and bed degradation which would cause a bank to fail. The second periodic report describes the collection of field data and the use of this data to test the bank stability analysis. (Lentz-W89_02825

DEFINITE PROJECT REPORT FOR SECTION 14. EMERGENCY STREAMBANK PROTEC-TION, SANGAMON RIVER SEWAGE TREAT-MENT FACILITY, RIVERTON, ILLINOIS.

Army Engineer District, Rock Island, IL. Available from the National Technical Information Service, Springfield, VA 22161, as AD-A192 079. Price codes: A04 in paper copy, A01 in microfiche. 63p, 5 tab, 7 plates, append.

Descriptors: *Bank protection, *Stream banks, *Cost-benefit analysis, *Erosion control, *Illinois, Sangamon River, Channel morphology, Costs,

The problem of streambank erosion at the junction of Sangamon Creek and the Sangamon River, at the village of Riverton, Illinois, Sewage Treatr Facility is addressed. The erosion is seriously affecting the streambank in the area of the effluent discharge outfall. The proposal for emergency streambank protection recommends channel relostreamoank protection recommends channel relo-cation along with placement of riprap along ap-proximately 230 linear feet of the right descending bank and along 60 linear feet of the right descend-ing bank of Sangamon Creek, including portions of the right descending bank of the Sangamon River. The total estimated cost for the project is \$57,100 with a benefit-to-cost ratio of 2.5. The project satisfies the criteria for Federal participation and is recommended for construction. (Lantz-PTT)

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

NEW APPROACHES TO MONITORING AQUATIC ECOSYSTEMS.

AQUATIC ECUSYSTEMS.

American Society for Testing and Materials, Philadelphia, PA. A symposium sponsored by ASTM Committee E-47 on Biological Effects and Environmental Fate and by the Ecological Society of America, Minneapolis, MN, 17-21 June 1985. ASTM Special Technical Publication 940. ASTM Publication Code Number 04-940000-16. 1987. 208 p. Edited by Terence P. Boyle.

Descriptors: *Environmental Policy, *Monitoring, *Regulations, *Water quality, *Data collection, *Ecosystems, Bioindicators, Peat bogs, Trace metals, Chesapeake Bay, Mollusk, Gas chromatography, Great Lakes, Siskiwit Lake, Isle Royale,

Research in the field of environmental monitoring results from three modern concerns: the regulation of the use of chemicals in environmental management; criticism of water quality data collection programs; and, the high degree of temporal variability in important components of natural ecosystems. Topics include: status of sport fish communities as a summary biological indicator of the health of the nation's streams and rivers; criteria to be considered in long-term pollution monitoring programs; the development of management-oriented goals in monitoring programs; the technique of using peat bogs as long term trend records for the assimulation of trace metals; the formulation of a long term monitoring program using many components of plankton and fish communities; the use of simple, socially relevant, management-oriented methods; results from a network of stations that have monitored environmental conditions for decedes in Chesenseks Ray, a monitoring recent Research in the field of environmental monitoring simple, socially refevant, management-oriented methods; results from a network of stations that have monitored environmental conditions for decades in Chesapeake Bay; a monitoring program designed to detect pollution in coastal waters using quantified responses of the blue mussel; the history of the sentinel organism monitoring strategy using bivalves to identify contaminated coastal areas, the problem of statistical resolution for sampling in long-term studies of population abundance and community composition is addressed; a technique using gas chromatography to determine the source of toxaphene residues analyzed in fish tissues collected in the Great Lakes, in Siskiwit Lake on Isle Royale and in rivers in the southeastern U.S.; a data management system is presented that incorporates data sets with high degree of temporal variability and that requires complex analyses; and quality assurance-quality control procedures that ensure data integrity. Three research needs emerged: procedures to determine the minimum data requirement for specific programs; new biodata requirement for specific programs; new bio-logical indicators sensitive to different aspects of water quality; and procedures that integrate envi-ronmental managers' concerns with the environ-mental scientist's expertise. (See also W89-02318 thru W89-02330) (Davis-PTT) W89-02317

MONITORING THE NATION'S WATERS-A NEW PERSPECTIVE,

Environmental Protection Agency, Washington, DC. Office of Toxic Substances. T. M. Murray.

In: New Approaches to Monitoring Aquatic Ecosystems. American Society for Testing and Materials, Philadelphia, PA. 1987. p 1-11, 3 fig, 3 tab, 6

Descriptors: *Statistics, *Monitoring, *National Fisheries Survey, *Water quality, *Ecosystems, *Biological surveys, *Fisheries, Statistical analysis, Stream fisheries, Surveys.

Until recently, attempts to monitor the condition of the nation's flowing waters focused on the physical and chemical characteristics of those waters while their biological communities were largely

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A-Identification Of Pollutants

ignored. In addition, data were not collected in a statistically designed fashion. The Environmental Protection Agency (EPA), with the cooperation of the U.S. Fish and Wildlife Service, conducted a statistical survey of the status of the nation's waters, their fish communities, and the limiting factors affecting these fish communities. This study, the National Fisheries Survey, is one tool with which the FPA will continue to monitor. study, the National Fisheries Survey, is one tool with which the EPA will continue to monitor national water quality. Among the major findings of the survey are that the majority of the nation's streams (67%) are currently suitable as sport fish habitat, water quality factors adversely affect the fish community in 56% of the nation's waters, and the ability of the nation's waters to support sport fish did not change appreciably during the 5 years which preceded 1982-overall, 91% of the nation's waters maintained a constant ability to support sport fish species during that period. (See also W89-02317) (Author's abstract)

STRATEGIES FOR LONG-TERM POLLUTION MONITORING OF THE COASTAL OCEANS, California Univ., Richmond. Sanitary Engineering and Environmental Health Research Lab. D. A. Segar, D. J. H. Phillips, and E. Stamman.
IN: New Approaches to Monitoring Aquatic Ecosystems. American Society for Testing and Materials, Philadelphia, PA. 1987. p 12-27, 23 ref.

Descriptors: "Water pollution effects, "Ecological effects, "Ecosystems, "Bioindicators, "Water quality, "Monitoring, Statistical analysis, Sampling, Design standards, Pollutant identification.

Monitoring of long-term effects of marine pollu-tion on regional marine ecosystems can be most useful to managers if based primarily on the use of bioindicators to monitor temporal changes in the mean background abundance of bioavailable con-taminants in the region. Design of successful long-term, regional bioindicator monitoring programs term, regional biolindicator monitoring programs requires that specific quantitative objectives be defined and expressed as null hypotheses. An optimum sampling and analysis plan designed to test these hypotheses must select the age, size range, and number of individuals per sample, the number of samples per site, the number of replicate analysis. of samples per sute, the number of replicate analy-ses per sample, and other factors based on the known sources of variance in the environment, sampled population, and analysis procedure. Sam-pling sites must be systematically selected to be affected as little as possible by contaminant inputs which vary temporarily on short time scales. Many suitable sites will require the transplantation of bioindicators, and the optimum program will probably require the exclusive use of transplanted populations. (See also W89-02317) (Author's abstract) W89-02319

INNOVATIVE DESIGNS FOR WATER QUAL-ITY MONITORING: ARE WE ASKING THE QUESTIONS BEFORE THE DATA ARE COL-

Minnesota Univ., St. Paul. Dept. of Forest Re-

For primary bibliographic entry see Field 7A. W89-02320

COMPARISON OF LAKE SEDIMENTS AND OMBROTROPHIC PEAT DEPOSITS AS LONG-TERM MONITORS OF ATMOSPHERIC POLLUTION,
Maine Univ. at Orono. Dept. of Geological Sci-

A. Norton, and J. S. Kahl.

S. A. Norton, and J. S. Kahl.
IN: New Approaches to Monitoring Aquatic Ecosystems. American Society for Testing and Materials, Philadelphia, PA. 1987. p 40-57, 6 fig. 2 tab, 18 ref. Office of Water Research and Technology Grant A-053-ME; U.S. National Park Service Grant C51600-2-006; U.S. National Science Foundation Grant DEB -7922142.

Descriptors: *Air pollution, *Limnology, *Paleolimnology, *Acid rain, *Peat bogs, *Heavy metals, *Trace metals, *Monitoring, Water quality, Data collection, Ecosystems, Lake sediments.

Ombrotrophic bogs receive all of their water and nutrients from the atmosphere. These systems are potentially well suited to record the chronology potentially well suited to record the chronology and magnitude of atmospheric deposition of chemically nonmobile elements. Lakes may misestimate the atmospheric flux since they receive focused material from their watershed as well as directly from the atmosphere. Cores of profundal lake sediment and ombrotrophic peat from both a humock and hollow were dated by Pb-210, utilizing the constant rate of supply model, and analyzed for 13 major and trace elements. All cores, except the hollow, have yielded a pattern of increasing concentration of lead (Pb), zinc (Zn), and vanadium (V) since the mid-1800's. Net accumulation rates over this period range from 0.1 to 5.0, 0.2 to 3.5, and 0.04 to 1.15 micrograms/sq cm/year for Pb, Zn, and V, respectively, in the lakes. In the hollows, the values are 0.2 to 2.1, 0.1 to 0.86, and <0.01 to 0.11; in the hummocks, they are 0.2 to 4.1, 0.2 to 3.0, and <0.02 to 0.42. Actual atmospheric deposition rates are probably between the 4.1, 0.2 to 3.0, and <0.01 to 0.42. Actual atmospheric deposition rates are probably between the rates from the two sites in the bog. The possible overestimation of flux to lake sediment can be compensated for natural flux by normalization of trace metal flux to titanium dioxide (TiO2) flux. trace metal flux to titanium dioxide (TiO2) flux. The adjusted ranges of atmospheric fluxes are 0 to 45, 0 to 2.4 and 0 to 0.4 (same units) for Pb, Zn, and V, respectively, in the lakes. The TiO2 normalization for peat chemistry is not a valid procedure, because the TiO2 content of peat is largely determined by erratic atmospheric inputs that are large in relation to the background content. The large mineral TiO2 content of sediments results in a negligible atmospheric TiO2 signal in lake sediment. (See also W89-02317) (Author's abstract) W89-02321

REVIEW OF THE CRATER LAKE LIMNOLO-GICAL PROGRAMS, Oregon State Univ., Corvallis. Coll. of Forestry. For primary bibliographic entry see Field 2H. W89-02322

MONITORING, RESEARCH, AND MANAGE-MENT: INTEGRATION FOR DECISIONMAK-ING IN COASTAL MARINE ENVIRONMENTS, National Coastal MARINE ENVIRONMENTS,

ING IN COASIAL MARINE ENVIRONMENTS, National Oceanic and Atmospheric Administra-tion, Rockville, MD. Ocean Assessments Div. J. S. O'Connor, and D. A. Flemer. IN: New Approaches to Monitoring Aquatic Eco-systems. American Society for Testing and Materi-als, Philadelphia, PA. 1987. p. 70-90, 5 fig, 61 ref.

Descriptors: *Coastal waters, *Environmental Quality, *Waste management, *Monitoring, *Water quality, *Data collection, Ecosystems, Chesapeake Bay, New York region, Marine re-

A rationale for making research and monitoring interdependent to maximize the contribution of both activities to environmental management is presented. Better choices of temporal and spatial scales of marine assessments, which improves managerial guidance from monitoring and research is emphasized. While particular scales are functions of particular environmental issues, the most useful scales overall appear to be long-term (including historical) and regional. The likelihood in the nearterm of only limited incremental advances in understanding ecosystem processes, with marginal derstanding ecosystem processes, with marginal improvements in predictability, leads to an argu-ment for more emphasis upon the use of manager-ailly helpful, simple models. An example of one such model is used to characterize the geographisuch model is used to characterize the geographical prevalence of fin erosion in winter flounder (Pseudopleuronectes americanus), relative to the sources of plausible causes, from Canada to Delaware Bay. Changing emphasis from laboratory bioassays to field population-level effects is an important and essential step toward integrating ecosystem-level knowledge into the managerial and regulatory milieu. It is now possible to quantify the geographic and recent, temporal associations among man's waste sources and some of their geographic and recent, temporal associations among man's waste sources and some of their biological effects. Further elaboration of source-fate-effects understanding with the help of simple models (e.g., indices) is often more useful to managers than is detailed, piecemeal quantification of seemingly intractable ecosystem dynamics. (See also W89-02317) (Author's abstract)

W89-02323

MULTIDECADE TREND-MONITORING PRO-GRAM FOR CHESAPEAKE BAY, A TEMPER-ATE EAST COAST ESTUARY.

Environmental Protection Agency, Annapolis, MD. Chesapeake Bay Program. For primary bibliographic entry see Field 7A. W89-02324

COASTAL MONITORING: EVALUATION OF MONITORING METHODS IN NARRAGAN-SETT BAY, LONG ISLAND SOUND AND NEW YORK BIGHT, AND A GENERAL MONITORING STRATEGY, Environmental Protection Agency, Narragansett, RI. Environmental Research Lab.

D. K. Phelps, C. H. Katz, K. J. Scott, and B. Beneralde.

Reynoids.

IN: New Approaches to Monitoring Aquatic Ecosystems. American Society for Testing and Materials, Philadelphia, PA. 1987. p 107-124, 4 fig, 2 tab, 47 ref. EPA Contract 68-03-3236.

Descriptors: *Environmental Policy, *Monitoring, *Water quality, *Data collection, *Coastal waters, Ecosystems, Narragansett Bay, Long Island Sound, New York Bight, Growth, Survival, Population dynamics.

Biological, chemical, and physical monitoring methods are evaluated and a research strategy for coastal monitoring is presented. The purpose of the strategy is to provide a conceptual model for detecting contaminant-induced perturbations of marine systems. The proposed strategy represents a shift in emphasis from analysis of chemical cona shift in emphasis from analysis of chemical con-centration to an initial biological examination of the effects of contaminants on marine organisms. Evidence of adverse biological effects obtained in this hierarchical strategy would result in the appli-cation of chemical and physical techniques to iden-tify the types and sources of contaminants. (See also W89-02317) (Author's abstract) W89-02325

'MUSSEL WATCH'--MEASUREMENTS OF CHEMICAL POLLUTANTS IN BIVALVES AS ONE INDICATOR OF COASTAL ENVIRON-MENTAL QUALITY,

MENTAL QUALITY,
Woods Hole Oceanographic Institution, MA.
Coastal Research Center.
J. W. Farrington, A. C. Davis, B. W. Tripp, D. K.
Phelps, and W. B. Galloway.
IN: New Approaches to Monitoring Aquatic Ecosystems. American Society for Testing and Materials, Philadelphia, PA. 1987. p 125-139, 3 fig, 2 tab,
25 ref. EPA Contract 68-03-3193.

Descriptors: *Bioindicators, *Bioaccumulation, *Monitoring, *Water quality, *Mussels, *Data collection, Ecosystems, Trace metals, Mollusks, Plutonium, Polychlorinated biphenyls, Tissue analysis.

The utility of the bivalve sentinel organism ap-The utility of the bivalve sentinel organism approach to monitoring for some chemicals of environmental concern in coastal and estuarine areas has been evaluated by regional and national programs and by smaller scale research efforts during the past 15 years. The extent and severity of coast-al contamination by chemicals such as polychlorinated biphenyls, chlorinated pesticides, trace metals, and plutonium has been assessed in several bivalve sentinel organism programs. Advantages and limitations of this approach are presented and and limitations of this approach are presented and discussed briefly within the context of both national and international efforts. (See also W89-02317) (Author's abstract) W89-02326

GAS CHROMATOGRAPHIC RESIDUE PAT-TERNS OF TOXAPHENE IN FISH SAMPLES FROM THE GREAT LAKES AND FROM RIVERS OF THE SOUTHEASTERN UNITED

STATES, Columbia National Fisheries Research Lab., MO. For primary bibliographic entry see Field 5B. W89-02328

Identification Of Pollutants-Group 5A

MONITORING AND QUALITY ASSURANCE PROCEDURES FOR THE STUDY OF REMOTE

WATERSHED ECOSYSTEMS,
Michigan Technological Univ., Houghton. Dept.
of Biological Sciences.

No. New Approaches to Monitoring Aquatic Ecosystems. American Society for Testing and Materials, Philadelphia, PA. 1987. p 189-198, 1 fig, 3 tab, Stottlemyer.

Descriptors: *Environmental impact, *Long-term studies, *Monitoring, *Data acquisition, *Quality control, Watershed management, Air pollution, Catchment basins, Cycling nutrients.

The advent of widespread, long-term environmental issues such as atmospheric contaminants re-quires reassessment of monitoring techniques and procedures to improve field and laboratory quality assurance. Mineral nutrient budgets in mature northern watershed and lake ecosystems which have widely varying inputs of atmospheric con-taminants are under study. These sites have been taminants are under study. I nese sites have been little studied, so consistency and appropriateness of sampling procedure and analysis is critical. A series of sampling and data quality objectives and procedures have been developed. They estimate the accuracy of field methods and sample integrity the accuracy of ned methods and sample integrity and determine analytical bias and precision in the laboratory. The system employs a series of internal and external audits and relies heavily on existing protocols developed by national monitoring and research organizations. (See also W89-02317) (Author's abstract) thor's abstract) W89-02330

STATEWIDE GROUNDWATER QUALITY MONITORING NETWORK DESIGN, MONITORING NELWORK DESIGN, Arizona Dept. of Environmental Quality, Phoenix. W. K. Hood, A. A. Myers, and D. L. Totman. IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 205-223 - 56 - 23 b. 12 ref. 222, 5 fig, 2 tab, 12 ref.

Descriptors: *Arizona, *Groundwater monitoring, *Network design, *Aquifers, *Water law, Economic aspects, Water resources development, Water quality control.

It is recognized by federal and state authorities that It is recognized by federal and state authorities that groundwater monitoring activities do not provide adequate data to support informed and reasonable decisions, and that a better approach to collecting and using monitoring information is needed. Arizona's Environmental Quality Act (EQA), adopted in 1986, mandates that the Arizona Department of Environmental Quality (ADEQ) conduct groundwater monitoring and improve the fundamental activities of monitoring activities carried out by agencies within the State. To meet this challenge, ADEQ has initiated the development of a statewide groundwater quality monitoring strategy. wide groundwater quality monitoring strategy. ADEQ is faced with resource allocation decisions ADEQ is faced with resource allocation decisions that must be directed toward the achievement of a cost-effective monitoring network which will contribute to maximum protection of the quality of Arizona's groundwater resource. ADEQ's proposed approach and ongoing activities to develop and implement a statewide groundwater quality monitoring network is presented. The strategy is comprised of six phases that include the definition of monitoring objectives, development of information data bases, evaluation and planning, groundwater monitoring network design, implementation, and assessment. The program will develop gradually and adjustments will be made to the strategy as knowledge and experience are gained. (See also W89-02331) (Author's abstract)

RANDOM SURVEY OF VOC'S, PESTICIDES AND INORGANICS IN ARIZONA'S DRINK-ING WATER WELLS,

Arizona Dept. of Environmental Quality, Phoenix. S. B. Ellingson, and M. B. Redding.
IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 223-247, 4 fig. 5 tab, 35 ref.

Descriptors: *Groundwater pollution, *Pesticides, *Arizona, *Pollutant identification, *Organic compounds, *Water supply systems, *Drinking water, *Heavy metals, *Chlorinated hydrocarbons, Water chemistry, Alkaline water, Hydrocarbons, Aquifers, Regional analysis, Groundwater, Statisti-

cal methods.

A random survey of public water supply wells was conducted to: (1) describe baseline water quality for inorganic and organic constituents in wells and monitor 30 unregulated chemicals with state Action Levels, (2) statistically project the water quality of Arizona's drinking water wells, and (3) provide a quality assurance audit for the anticipated state regulatory self-monitoring program. Well-head samples were collected from permanent community systems serving 1,000 or more people. Forty wells throughout the state were tested from July to September 1986 and 16 wells were resampled in January 1987 to confirm initial results. Parameters included several physical and chemical constituents, inorganic and organic drinking water contaminants, and the 30 unregulated volatile organic compounds (VOC's) and pesticides with state Action Levels. Most wells were deep (median 125.0 m), contained hard water (200 CaCO3/L) and were low in nitrate (med. 191 mg N/L). One well exceeded the primary maximum contaminant and were low in nitrate (med. 1.91 mg N/L). One well exceeded the primary maximum contaminant level for arsenic and 12 surpassed the temperature-dependent fluoride limit. Four wells were confirmed for VOC's and a single well exhibited pesticide contamination. Trichloroethene (TCE), perchloroethene, 1,1-dichloroethene, 1,2-dichloroethene, 1,2-di VOC and/or pesticide contamination. (See also W89-02331) (Author's abstract)

RECOGNIZING PETROLEUM HYDROCAR-BON CONTAMINATION IN THE VADOSE ZONE WITH PHOTOIONIZATION DETEC-TION SCANNING OF FIELD SAMPLES, Pirnie (Malcolm), Inc., Phoenix, AZ. R. J. Brose, and J. T. Gross. IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 365-373. 1 fig. 1 tab. 6 ref

373, 1 fig, 1 tab, 6 ref.

Descriptors: *Pollutant identification, *Soil water, *Photoionization detectors, *Hydrocarbons, Descriptors: "Pollutant identification, "Soil water, "Photoionization detectors, "Hydrocarbons, "Groundwater pollution, "Measuring instruments, "Field tests, "Chemical analysis, Groundwater monitoring, Aquifers, Hydrology, Geohydrology, Analytical methods, Organic compounds.

The ability for rapid detection of petroleum hydro-carbons in the vadose zone has become increasing-ly important as more stringent environmental regu-lations are developed and enforced. Real time field data are needed to avoid indiscriminate and costly sampling and laboratory analyses, to optimize the amount of information gathered in the field, and to reduce the overall time required to accurately di-agnose subsurface contamination. Photoionization detectors (PID) afford the field investigator the ability to detect relative concentrations of volatile and semi-volatile organics in air, soils, and ground-water samples during field investigations. Portable PID instruments are relatively easy and reliable to water samples during field investigations. Portable PID instruments are relatively easy and reliable to use in the field, and are less expensive than many other instrumental methods. Data from an investigation at a southwestern desert location illustrate the close correlation that can be obtained between field PID instrument readings and laboratory determined concentrations of petroleum hydrocarbon contamination in vadose zone soils samples. PID data reflected the accumulation of petroleum hydrocarbons above a subsurface clay lens located beneath a point source of contamination. (See also W89-02331) (Author's abstract)

PERFORMANCE OF ANALYTICAL TEST KITS ON METAL FINISHING WASTEWATER SAM-PLES,

Scientific Control Labs., Inc., Chicago, IL. For primary bibliographic entry see Field 5D. W89-02403

APPLICATION OF XAD-4 SOLID SORBENT AND HPLC WITH ELECTROCHEMICAL DE-TECTION TO THE ANALYSIS OF PHENOLS

Oak Ridge National Lab., TN. Analytical Chemis-

try Div. M. P. Maskarinec, D. L. Manning, and R. W.

Available from the National Technical Information Service, Springfield, VA. 22161, as ADA 182613. Price codes: A02 in paper copy, A01 in microfiche. Report No. ORNL/TM-10309, June 1987. 22p, 2

Descriptors: *Water analysis, *XAD-4 resin, *Resins, *High performance liquid chromatography, *Phenols, Chemical analysis, Electrochemistry, Chromatography.

Phenol; o., m., and p-cresols; 2,4,5- and 2,4,6- trichlorophenols; 2,3,4,5- and 2,3,5,6-tetrachlorophenols; and pentachlorophenol collected from water samples by adsorption on XAD-4 cartridges. After elution with diethyl ether and returning to an aqueous media, the phenols are determined by high performance liquid chromatography with electrochemical detection (HPLC/EC). Initial studies demonstrated that a C sub 18 reverse phase column could not resolve all of these phenols. However, a cyclobond 1-beta column composed of a cyclodestrin bonded to a high purity silica, was able to separate the phenols. An electrochemical detector with a glassy carbon electrode held at +1 V vs an Ag/AgCl reference electrode allowed detection limits of 1 micrograms/L for phenol and 5 micrograms/L for the chlorophenols at a signal to noise ratio of 3. (Lantz-PTT) ratio of 3. (Lantz-PTT)

DIRECTORY OF PRECIPITATION MONITOR-ING SITES, NATIONAL ATMOSPHERIC DEP-OSITION PROGRAM/NATIONAL TRENDS NETWORK (NADP/NTN).

National Acid Precipitation Assessment Program Washington, DC.

For primary bibliographic entry see Field 7A. W89-02480

RESULTS OF INTERCOMPARISON STUDIES FOR THE MEASUREMENTS OF PH AND SPE-CIFIC CONDUCTANCE AT NATIONAL AT-MOSPHERIC DEPOSITION PROGRAM/NA-TIONAL TRENDS NETWORK MONITORING SITES, OCTOBER 1981-OCTOBER 1985,

Geological Survey, Lakewood, CO. Water Resources Div.

L. J. Schroder, and M. H. Brooks. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 84-4563, 1987. 22p, 30 fig. 4 tab, 5 ref.

Descriptors: *Specific conductance, *Hydrogen ion concentration, *Water analysis, *Acid rain, Precision, Air pollution, Water pollution sources.

Ten intercomparison studies to determine the accuracy of pH and specific-conductance measurements, using dilute-nitric acid solutions, were managed by the U.S. Geological Survey for the National Atmospheric Deposition Program and the National Trends Network precipitation networks. These precipitation networks set quality-control goals for site-operator measurements of pH and specific conductance. The accuracy goal for pH is plus or minus 0.1 pH unit; the accuracy goal for specific conductance is plus or minus 4 microsiemens per centimeter at 25 degrees Celsius. These intercomparison studies indicated that an average of 65 percent of the site-operator pH measurements intercomparison studies indicated that an average of 65 percent of the site-operator pH measurements and 79 percent of the site-operator specific-conductance measurements met the quality-control goal. A statistical approach that is resistant to outliers was used to evaluate and illustrate the results obtained from these intercomparisons. (USGS)

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A-Identification Of Pollutants

W89_02485

EFFECTS OF HEAVY METAL POLLUTION ON EPILITHIC BACTERIA, Purdue Univ., Lafayette, IN. Dept. of Biological

For primary bibliographic entry see Field 5C. W89-02552

METHODS FOR COLLECTION AND ANALY-SIS OF AQUATIC BIOLOGICAL AND MICRO-BIOLOGICAL SAMPLES,

Geological Survey, Lakewood, CO. Water Resources Div.

For primary bibliographic entry see Field 7B. W89-02568

GROUNDWATER PROTECTION BY ACCEL-ERATED TESTING OF ORGANIC CHEMICAL BREAKTHROUGHS OF SOIL BARRIERS, Connecticut Univ., Storrs. Dept. of Chemistry. J. D. Stuart, and H. D. Luce. Available from the National Technical Information Services, Springfield, VA 22161 as PB88-225776/ AS. Price codes: A03 in paper copy; A01 in micro-fiche. Connecticut Institute of Water Resources, Storrs, Completion Report, September 1987. 20p, 4 fig. 4 tab, 12 ref. Contract No. 14-08-0001-G1215. Project No. USGS G1215-03.

Descriptors: *Groundwater pollution, *Ground-water protection, *Organic chemicals, *Sorption, *Extraction method, Groundwater, Leachate, Or-ganic wastes, Hazardous wastes, Soil types, Pollut-

It has been estimated that over one-half of all organic chemicals used as household solvents, detergents and cleaners, as well as a wide variety of chemicals used in industrial processes are indiscriminately disposed of in landfills. These chemicals have the potential of leaching through the soils beneath and down gradient of the landfill and reaching the groundwater. Houle and Long (See W81-04489) have reported using a series of graded, sequential batch extractions to randful determine W81-04489) have reported using a series of graded, sequential batch extractions to rapidly determine the ability of a soil to remove inorganic chemicals from a leachate. The purpose of this research was to use Houle and Long's general method and to develop an accelerated, laboratory-based method to evaluate the sorption of selected, nonvolatile, partially water soluble, organic chemicals by different types of soil. This research has shown that it is feasible to use the graded, sequential batch extraction method to determine within one day if a soil is effective in sorbing one or a limited number traction method to determine within one day if a soil is effective in sorbing one or a limited number of organic compounds. The sorption properties of two soils, one an Ap horizon of a Scarboro mucky, loamy sand (mixed mesic, Histic Humaquepts) and an Ap horizon of a Baldwin silty clay, (fine monthorillimitic, thermic Vertic Ochraquaft) were compared. For both dimethylphthalate and diethylphthalate, the graded, sequential batch extraction method indicated that the mucky, loamy sand removed lower amounts of these chemicals than did clayey soil. (Stuart-CT Univ.)

CHROMATOGRAPHIC APPROACHES TO TRACE ELEMENT SPECIATION, Macdonald Coll., Ste. Anne de Bellevue (Quebec). Dept. of Food Science and Agricultural Chemis-

try. W. D. Marshall.

IN: Metal Speciation: Theory, Analysis and Application. Lewis Publishers, Chelsea, Michigan. 1988.

Descriptors: *Chromatography, *Trace elements, *Trace metals, *Chemical analysis, *Atomic absorption spectroscopy, *Mass spectrometry, Gas chromatography, High performance liquid chromatography, Selectivity, Path of pollutants, Data acquisition.

The problem of trace element speciation becomes one of resolving and determining a group of analytes whose only basis of commonality is the presence of the trace element within their structure.

One successful approach to speciation has been to couple a chromatographic step with a detection system which is both very highly sensitive and selective for the element of interest. Both gas chromatography (GC) and high performance liquid chromatography (HPLC) are popular, and the most promising detectors are mass spectrometric (MS) and atomic spectroscopy (AS) systems. The limitations of the current approaches are considered and future directions are suspected. Atomic ered and future directions are suggested. Atomic absorption spectroscopy and atomic emission spec-troscopy are discussed, as well as other detectors. truscopy are discussed, as well as other detectors. Atomic spectroscopy offers several advantages in-cluding applicability to a wide range of trace elements, very high selectivities, and very good sensitivities. (See also W89-02640) (VerNooy-PTT) W89-02648

WATER ANALYSIS: A PRACTICAL GUIDE TO PHYSICO-CHEMICAL, CHEMICAL AND MI-CROBIOLOGICAL WATER EXAMINATION AND QUALITY ASSURANCE,

For primary bibliographic entry see Field 7B. W89-02777

VOLUNTEER LAKE MONITORING PROGRAM, 1987. VOLUME I: STATEWIDE SUMMARY REPORT,
Illinois State Environmental Protection Agency,
Springfield. Div. of Water Pollution Control.

For primary bibliographic entry see Field 7B. W89-02869

TWO TEST PROCEDURES FOR RADON IN DRINKING WATER: INTERLABORATORY COLLABORATIVE STUDY, Lockheed Engineering and Management Services Co., Inc., Las Vegas, NV.

E. L. Whittaker, J. D. Akridge, and J. Giovino. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-197306. Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA/600/2-87/082, September 1987. 45p, 6 tab, 7 ref, 6 append. EPA Contract 68-03-3249.

Descriptors: *Water analysis, *Pollutant identifica-tion, *Drinking water, *Radon, Chemical analysis, Water analysis, Comparison studies.

Two analytical methods for the determination of radon in water were tested in a multilaboratory study with 28 participating laboratories. Eighteen laboratories analyzed prepared samples by the liquid scintillation (LS) method, and twelve laboraliquid scintillation (LS) method, and twelve labora-tories analyzed the same samples by the Lucas Cell (LC) method. A comparison of the grand averages for the three samples with the known values for those samples showed good accuracy for both methods. The accuracy index was not < 94% for any of the three samples when analyzed by either method. Test results for the LS method showed method. Test results for the LS method showed better precision than test results for the LC method. The average repeatability (within-laboratory) precision for the LS method was 3.6 + or - 3.0% at 95% confidence and for the LC method it was 6.4 + or - 3.8% at 95% confidence. The average reproducibility (combined within- and between-laboratory) precision for the LS method was 10.2 + or - 4.2% at 95% confidence and for the LC method it was 17.6 + or - 4.2% at 95% confidence. (Author's abstract) W89-02956

SIMPLIFIED LABORATORY PROCEDURES FOR DO DETERMINATION (APHA/AWWA/ WPCF METHOD), Lenox Inst. for Research, Inc., MA. For primary bibliographic entry see Field 7B. W89-02958

DEUTERIUM ISOTOPE COMPOSITION OF PALAEOINFILTRATION WATERS TRAPPED IN SPELEOTHEMS,

Institute of Physics and Nuclear Techniques, Krakow (Poland).

Available from the National Technical Information

Service, Springfield, VA 22161, as DE88-700609. Price codes: A02 in paper copy, A01 in microfiche. Report No. IAEA-R-3660-F, May 1987. Final Report for the Period 1 December 1984 - 30 November 1986. 4p, 5 ref.

Descriptors: *Deuterium, *Radioisotopes, *Pollut-ant identification, *Caves, Thorium radioisotopes, Uranium, radioisotopes, Geochemistry.

Uranium, radioisotopes, Geochemistry.

Analytical and methodological aspects of combined isotope investigations of carbonate cave deposits are thoroughly discussed in the report. Weight is put on isotope analyses of fluid inclusions (d and 18-O content) extracted from speleothems of known age. Dating was done by the 230-Th/234-U ratio method. Isotopic analyses of speleothems originating from European caves allowed some important conclusions to be formulated regarding past climatic and environmental conditions prevailing over the European continent during the last 300,000 yrs: (a) gamma-D values of fluid inclusions suggest a remarkable constancy of the heavy-isotope content of European palaeoinfiltration waters recharged during interglacial periods, (b) a climate-induced, long-term changes in isotopic composition of precipitation and surface air temperature over Europe can be characterized by the deuterium gradient of about 1.4 parts/thousand, an apparent constancy of the continental gradient in deuterium content of European palaeoinfiltration waters as judged from the fluid inclusion data suggests that atmospheric circulation over Europe did not undergo substantial changes for at least 300,000 years. (Author's abstract)

MONITORING AND SURVEILLANCE, National Inst. for Water Research, Pretoria (South Africa).

For primar W89-02991 ary bibliographic entry see Field 7B.

ANALYSIS OF BIOMONITORING TECH-NIQUES TO SUPPLEMENT EFFLUENT GUIDELINES.

Energetics, Inc., Columbia, MD. Available from the National Technical Information Available from the National Technical Information Service, Springfield, VA 22161, as DE88-005361. Price codes: A04 in paper copy, A01 in microfiche. Report No. DOE/PE/16036-T1, November 18, 1985. Final Report. 83p, 4 fig. 4 tab, 50 ref, 5 append. DOE Contract DE-AC01-84PE16036.

Descriptors: *Water quality control, *Standards, *Monitoring, Water sampling, Bioassay, Biological studies, Toxicity, Legislation.

EPA's position on biomonitoring strategies, the applicability and limitations of these strategies, and potential alternatives to biomonitoring, are reviewed. Clean Water Act of 1985 amendments is to require states to implement progressive programs of toxic pollutant load reduction where BAT is not sufficient to meet state water quality standards and support public health and water quality objectives of the Act. This is reflected in a greater dependof the Act. This is reflected in a greater depend-ence upon bioassay and monitoring techniques as a means of determining the quality of waters. The use of toxicity bioassays in water pollution control studies has become increasingly popular as an ap-proach to assessing water quality. Briefly, a toxici-ty bioassay is a procedure that uses living orga-misms to test the effects of chemical substances. nisms to test the effects of chemical substances. There are a variety of ways to use a bioassay, including the following: to determine the relative toxicities of two or more chemicals; to assess toler-ances of aquatic organisms to different substances; and to determine whether or not water with cer-tain characteristics is suitable for assorted aquatic tain characteristics is suitable for assorted aquatic species. The two most widely used types of toxici-ty bioassays are the static and the flow-through. A flow-through toxicity test is often conducted using a diluter system and a continuous feed of effluent and dilution water. A static toxicity test is conductand cliution water. A static toxicity test is conductively different and the conductive system, into which effluent and diluent are added manually. Only one test sample is added at the beginning of the test. A renewal toxicity test uses the same delivery system as a static test but

Identification Of Pollutants-Group 5A

the test solutions are changed on a predetermined schedule. (Lantz-PTT) W89-02994

CRITICAL ASSESSMENT OF THE 'DYNAMIC DAPHNIA TEST' (KRITISCHE BETRACHTUNG DES 'DYNAMISCHEN DAPHNIEN

TESTS"),
Bayer A.G., Leverkusen (Germany, F.R.). Plastics
and Coatings Div.
N. Caspers.
N. Caspers.
Zeitschrift fuer Wasser - und Abwasser Forschung
ZWAGAQ, Vol. 21, No. 4, p 152-154, August
1988. 2 fig, 1 tab, 7 ref. English summary.

Descriptors: *Water quality control, *Bioindicators, *Monitoring, *Daphnia, Testing procedures, Dynamic daphnia test, Wastewater, Natural

The prototype of the Dynamic Daphnia tests system was first introduced in 1978 as 'an automatsystem was first introduced in 1978 as an automatic means for monitoring natural and waste waters. The second-generation apparatus, as it has been marketed since early 1987, in based on the following measurement principle: Under free-flowing conditions, juvenile daphnia of selected size and condition in two test chambers (or a test and a reference chamber) are exposed to the influence of condition in two test chambers (or a test and a reference chamber) are exposed to the influence of test waters (e.g., wastewater, cooling water, natural water). When a certain level of hyperactivity (an indicator of the onset of stress) is exceeded, an alarm is automatically tripped. A difficulty is encountered even in setting up the apparatus—the establishment of the basic parameters, e.g., the normal swimming behavior of a daphnia population, or the normal reaction of daphnia in chronic r subchronic toxicity tests. for example, in a gradually-increasing (by a factor of over 1000) concentration of 1, 2-dichlorethane there was no marked alteration in the activity behavior of juvenile daphnia. Investigation under reproducible laboratory conditions has shown that this test system has conceptual and methodological weaknesses. The overriding weak points of the 'Dynamic Daphnia Test' place in question its usability as a continuously-operating, dependable system for water/wastewater/receiving water monitoring. For the quick detection and quantitative determination of undesirable substances in the milligram nation of undesirable substances in the milligram range, more suitable analytical procedures are available. (Friedmann-PTT)

W89-03046

NEW SYSTEM OF SEEPAGE SAMPLING FOR THE DETERMINATION OF VOLATILE ORGANIC SUBSTANCES (NEUES SYSTEM DER SICKERWASSERGEWINNUNG ZUR BESTIMMUNG LEICHTFLUCHTIGER ORGANISCHER SPURENSTOFFE),
Technische Univ., Munich (Germany, F.R.). Lehrstuhl fuer Hydrogeologie and Hydrochemie.
J. Straub, P. Udluft, and L. Weil.
Zeitschrift fuer Wasser - und Abwasser Forschung ZWAGAQ, Vol. 21, No. 4, p 155-157, August 1988. 3 fig, 4 ref. English summary.

Descriptors: *Pollutant identification, *Seepage, *Sampling, *Organic compounds, On-site investigations, Laboratories.

In the seepage sampling of volatile organic compounds with suction cups, problems arise because the volatile substances degas in the vacuum-bottle or sample-bottle. Therefore, a sample collecting apparatus was constructed, which is a closed system to prevent degassing by collecting the sample in a gastight glass syringe. Laboratory experiments showed that the apparatus is tight even under high pressure. A degassing of volatile subunder high pressure. A degassing of volatile sub-stances could not be found. (Author's abstract) W89-03047

DETERMINATION OF METALS WITH ICPAES IN COMPARISON TO THE AAS, PHOTOMETRY, AND MILLIVAL-BALANCE OF THE ANIONS (DIE METALLBESTIMMUNG MIT DER ICP-AES IM VERGLEICH ZUR AAS, PHOTOMETRIE UND ANIONEN-MILLIVAL-

Landesamt fuer Wasserwirtschaft Rheinland-Pfalz.

Landesamt fuer Wasserwirtschaft Rheinland-Pfalz, Mainz (Germany, F.R.). J. Grohme, M. Muller, D. Rinne, and M. Rogge. Zeitschrift füer Wasser - und Abwasser Forschung. ZWAGAQ, Vol. 21, No. 4, p 158-163, August 1988. 9 fig, 4 tab, 13 ref. English summary.

Descriptors: *Pollutant identification, *Heavy metals, *Trace elements, *Groundwater pollution, *Photometry, *Spectrometry, Statistical analysis, Spectral analysis, Potassium, Sodium, Magnesium, Calcium, Manganese, Iron, Silicon, Comparison under the comparison of the comparison of

The elements K, Na, Mg, Ca, Mn, Fe, and Si were determined in more or less contaminated ground-water by atomic emission spectrometry with ICP. Each determination was repeated by atomic absorption spectrometry and in the case of silicon by a photometric method. These pairs of values were examined by an orthogonal regression analysis due to their equal value. Beside an arbitrary view about the equivalence, a new statistical test was developed. Both tests show no differences in the analytic the equivalence, a new statistical test was developed. Both tests show no differences in the analytical values between the different analytical methods. In addition, the millival balances of AAS and AES were compared with the corresponding millival balances of the anions. The degree of agreement good and in the case of the ICP-AES very good. (Author's abstract)
W89-03048

DETERMINATION OF TRACES OF THALLI-UM IN VARIOUS MATRICES, Commission of the European Communities, Brus-sels (Belgium). Community Bureau of Reference. B. Griepink, M. Sager, and G. Tolg. Pure and Applied Chemistry PACHAS, Vol. 60, No. 9, p 1425-1436, September 1988. 12 tab, 83 ref.

Descriptors: *Trace Metals, *Thallium, *Spectrometry, *Chemical analysis, *Water analysis, Atomic absorption spectrophotometry, Trace levels, Emission spectroscopy, Voltammetry.

This report to the International Union of Pure and Applied Chemistry (IUPAC) Commission on Microchemical Techniques and Trace Analysis, gives recommendations for the digestion, preconcentration, and determination of thallium in various matrices including natural waters, body fluids, biotic materials, and geological samples. The analytical techniques considered include spectrophotometry, flame atomic absorption spectrophotometry. fame atomic absorption spectrophotometry (FAAS), graphite furnace atomic absorption spectrophotometry emission spectrometry and voltametry. The determination of Tl from most matrices at the microgram/l level is relatively simple, for which FAAS is the method to be recommended. A universal analytical procedure for Tl at the nanouniversal analytical procedure for 11 at the nano-gram/g level does not yet exist, although this level is common in most environmental matrices. Some recommendations are presented for favorable com-binations of methods suited for certain types of matrices at this detection limit. (Sand-PTT)

EXTRACTION, CLEAN-UP AND GROUP SEP-ARATION TECHNIQUES IN ORGANOCH-LORINE TRACE ANALYSIS,

Marine Lab., Aberdeen (Scotland). D. E. Wells.

Pure and Applied Chemistry PACHAS, Vol. 60, No. 9, p 1437-1448, September 1988. 2 tab, 102 ref.

Descriptors: *Pesticides, *Chlorinated hydrocarbons, *Chemical analysis, *Trace levels, *Halogenated pesticides, *Water analysis, *Water polution sources, Air pollution, Fly ash, Biocides, Sludge, Soil, Sediments, Gas chromatography, Mass spec-

This report to the International Union of Pure and Applied Chemistry (IUPAC) Commission on Mi-crochemical Tecniques and Trace Analysis, Work-ing Party on Organic Trace Analysis, critically reviews and gives recommendations for the isola-tion/extraction and subsequent clean-up stages of analysis of persistent halogenated hydrocarbons, related pesticides and biocides which occur at trace levels in the environment. Protocols are

given for the sampling, clean-up and separation techniques for residue analysis, prior to analysis by gas chromatography or gas chromatography-mass spectrometry, in air samples (fly ash), water, solids (sewage sludge, sediments, soils), plant materials, body tissue and fluids, and mild, oil and fats. (Sand-PTT) W89-03068

BIOCHEMICAL TESTING OF GROUNDWAT-

BIOCHEMICAL FESTING
ER,
Stadtwerke Mainz A.G. (Germany, F.R.).
U. Obst, and A. Holzapfel-Pschorn.
Water Science and Technology WSTED4, Vol.
20, No. 3, p 101-107, 1988. 5 tab, 15 ref.

Descriptors: *Toxicity, *Groundwater, *Biochemical tests, *Microorganisms, *Biomass, Groundwater pollution, Water treatment, Biological treatment, Enzymes, Organic compounds, Surface

Several biochemical methods for easy testing of the microbial turnover activity, the microbial biomass, and toxic effects of pollutants are presented. These methods are simple, quick, and cheap and can be performed in any laboratory with standard equipment. They consist of photometric or fluorometric determinations of various enzymes, the electron transport system, and DNA. Some examples show correlation between enzymatic activities and organic compounds, between enzymatic activities and promounds of the standard enzymatic activities and promounds of the standard enzymatic activities and promounds of the standard enzymatic activities and biomass, and the influences of surface water on groundwater and biological water treatment. The application of these tests is proposed for samples of the whole water cycle in order to get more information supplementary to classical biological and chemical investigations. (Author's abstract) W89-03085

UTILITY OF SOLUBLE REACTIVE PHOS-PHORUS MEASUREMENTS IN GREAT LAKES SURVEILLANCE PROGRAMS: A SUM-

MARY, National Oceanic and Atmospheric Administra-tion, Ann Arbor, MI. Great Lakes Environmental Research Lab.

Journal of Great Lakes Research JGLRDE, Vol. 14, No. 3, p 377-379, 1988. 20 ref.

Descriptors: "Phosphorus, "Oligotrophic lakes, "Great lakes, "Pollutant identification, "Monitoring, Phosphorus compounds, Lakes, Review, Data interpretation, Chemical analysis.

This report summarizes the findings and conclusions of a special workshop convened by the National Water Research Institute at Burlington, Ontario, to review differences in opinion regarding the utility and continuation of soluble reactive phosphorus (SRP) measurements in the Great Lakes surveillance programs. SRP measurements were discussed taking into account recent developments in understanding the role of phosphorus in bacterial and algal nutrition, phosphorus utilization, and phosphorus turnover times. The workshop concluded that SRP is an acceptable measure of dissolved bioavailable phosphorus when concentrations are significantly above detection limits, and recommended continuation of SRP measurements on surveillance cruises until a better alternative is developed. (Author's abstract) W89-03180

ULTRA-TRACE-LEVEL DETERMINATION OF COBALT, CHROMIUM, AND HYDROGEN PEROXIDE BY LUMINOL CHEMILUMINES-CENCE DETECTED WITH A CHARGE-COU-

PLED DEFECTED WITH A CHARGE-PLED DEVICE, Arizona Univ., Tucson. Dept. of Chemistry. For primary bibliographic entry see Field 7B. W89-03181

CONTINUOUS FLOW DETERMINATION OF CARBON DIOXIDE IN WATER BY MEM-BRANE SEPARATION-CHEMILUMINESCENT

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A-Identification Of Pollutants

Osaka Prefectural Univ., Sakai (Japan). Lab. of Environmental Chemistry. For primary bibliographic entry see Field 7B. W89-03182

SCALED CHRYSOPHYTES (CHRYSOPHY-CEAE) AS INDICATORS OF PH IN SUDBURY,

CEAE) AS INDICATORS OF PH IN SUDBURY, ONTARIO, LAKES, Trent Univ., Peterborough (Ontario). Trent Aquatic Research Centre. S. D.bixt, A. S. Dixit, and R. D. Evans. Canadian Journal of Fisheries and Aquatic Sciences CIFSDX, Vol. 45, No. 8, p 1411-1421, August 1988. 5 fig, 5 tab, 40 ref.

Descriptors: *Chrysophyta, *Acid rain effects, *Lake sediments, *Limnology, *Ontario, *Hydrogen ion concentration, *Acidic water, *Bioindicators, Lakes, Regression analysis, Paleolimnology, Mathematical studies, Heavy metals, Aquatic pop-

Surface sediment chrysophytes (Chrysophyceae) of 30 Sudbury, Ontario, lakes were analyzed to investigate the relationship of these algal microfossils with the limnological characteristics of the study lakes. The distribution of the majority of common chrysophyte taxa is correlated closely with lake water pH, pH-related factors, or both. with lake water pH, pH-related factors, or both. Chrysodidymus synuroideus, Synura echinulata, and Chrysosphaerella longispina appear to be indicators of strongly to moderately acidic waters whereas M. pseudocoronata and M. caudata are indicators of circumneutral to alkaline waters. Using multiple regression of pH indicator chrysophyte assemblages against the measured lake pH, a calibration equation was developed to compute chrysophyte-inferred pH. Chrysophyte-inferred pH values were closely related with measured lake water pH fr squared = 0.72). It is indicated that in the absence of historical pH data, stratigraphic analysis of scaled chrysophytes would provide useful information about the history of lake acidification in the Sudbury area. There is some indication that high metal concentrations, in addition to tion that high metal concentrations, in addition to pH, may influence chrysophycean species distribution in acidic lakes. (Author's abstract) W89-03227

NEW POROUS POLYMER FOR OFF-LINE PRECONCENTRATION OF CHLOROPHEN-OLS FROM WATER,

Marie Curie-Sklodowska Univ., Lublin (Poland).

Marie Curie-Skiodowska Univ., Lubin (Poland). Inst. of Chemistry. J. Gawdzik, B. Gawdzik, and U. Czerwinska-Bil. Chromatographia CHRGB7, Vol. 25, No. 6, p 504-506, June 1988. 1 fig. 2 tab, 19 ref.

Descriptors: *Polymers, *Chromatography, *Wastewater analysis, Wastewater treatment, *Water analysis, Phenols, Copolymerization, Pre-

A new porous polymer obtained by the copolymerization of two cross-linking agents (1,4-dimethacryloyloxymethyl naphthalene and divinylbenzene) was used for the off-line preconcentration of chlorophenols from water solutions by solid-phase cnioropnenois from water solutions by soile-phase extraction. In order to establish its applicability to preconcentration the recoveries and breakthrough volumes of phenol, (2,3-chlorophenols; 2,4-dichlor-ophenols and 2,4-6-trichlorphenol) were studied. The recoveries were compared with those ob-tained for chemically bonded phases containing tained for chemically bonded phases containing hexyl and octadecyl groups. Comparing the recovery values of chlorophenols on these materials from aqueous solutions containing 2 microg per ml of each compound, it can be seen that the copolymerization gives yields about 100%. The results show that short precolumns containing this copolymer can be successfully used in the preconcentration of chlorophenols from waste water. (Miller-PTT) PTT) W89-03286

CAPILLARY GAS CHROMATOGRAPHIC DETERMINATION OF AMITROLE IN WATER WITH ALKALI FLAME IONIZATION DETECTION

Centraal Inst. voor Voedingsonderzoek TNO, Zeist (Netherlands). Toxicological Analysis Dept. J. M. van der Poll, M. Vink, and J. K. Quirijns. Chromatographia CHRGB7, Vol. 25, No. 6, p 511-514, June 1988. 4 fig, 1 tab, 9 ref.

Descriptors: *Gas liquid chromatography, *Water analysis, *Pollutant identification, *Pesticides, *Amitrole, Alkali flame ionization detection, Groundwater, Groundwater pollution.

A method to reach a very low detection limit necessary to determine pesticides in groundwater and drinking water is presented. Specifically, a capillary gas-liquid chromatographic method with alkali flame ionization detection is described for the determination of amitrole in water samples. The method is based on the acetylation of the amitrole with acetic anhydride. The limit detection is about 0.1 microg per l of water. The average recovery in groundwater is 97%. (Miller-PTT) W89-03287

IMPAIRMENT OF MOBILITY AND DEVEL-OPMENT IN FRESHWATER SNAILS (PHYSA FONTINALIS AND LYMNAEA STAGNALIS) CAUSED BY HERBICIDES, Gesamthochschule Kassel (Germany, F.R.). Fach-bereich 19 - Biologie, Chemie. For primary bibliographic entry see Field 5C. W89-03290

ANALYSIS OF VOLATILE HALOGENATED HYDROCARBONS ON THE PPQ SCALE, Innsbruck Univ. (Austria). Inst. fuer Radiochemie und Angewandte Physikalische Chemie. M. Huber, G. Estermann, and G. Bonn. Fresenius Zeitschrift füer Analytische Chemie ZACFAU, Vol. 331, No. 5, p 486-489, July 1988. 6 fig, 1 tab, 13 ref.

Descriptors: "Hydrocarbons, "Gas chromatogra-phy, "Drinking water, "Water analysis, "Water analysis, "Chemical analysis, "Pollutant identifica-tion, "Separation techniques, Headspace, Drinking water, Milk.

The sensitivity of headspace gas chromatography with electron capture detection was investigated for routine measurement at the parts per quadrilion level both in aqueous samples and other biological matrices. The mixtures of halogenated hydrocarbon standards were prepared from analytical grade chemicals and dissolved in deionized and preheated water. For all samples, including drinking water, mother's milk, beer, contamination was carefully avoided, and each experiment was carried out in triplicate. The separation of volatile hydrocarbons by use of the headspace technique was optimized with regard to the stationary phase and temperature programming to achieve separawas optimized with regard to the stationary phase and temperature programming to achieve separations within as short a period of time as possible and thus enable use of the method in routine environmental analysis. Halogenated hydrocarbons could be determined in various biological matrices by headspace chromatography and either mass reactionerities or alection earlier detection. Since spectrometric or electron capture detection. Since no time-consuming sample pretreatment is necessary, the method chosen is suited for routine use, om 1, the method chosen is suited for routine use, the most important compounds being analyzable within 6 minutes. (Miller-PTT) W89-03301

COMPARATIVE STUDY OF DIFFERENT TECHNIQUES FOR NITRATE DETERMINA-TION IN ENVIRONMENTAL WATER SAM-

TION IN ENVIRONMENT OF THE STATE OF T

Descriptors: *Water analysis, *Nitrates, *Pollutant identification, *Spectrophotometry, Comparison studies, Cadmium reduction method.

Three different methods for nitrate determination in environmental samples were compared. The in-

fluences of Cl(-), NO2(-), Fe(+2) and Fe(+3) in different concentrations were also investigated. From the data obtained, it is concluded that the From the data obtained, it is concluded that the cadmium reduction method is the most suitable for every type of environmental water samples, whereas the electrode screening method suffers from many interferences and is not suitable for any type of sample. The direct spectrophotometric method has been found to be applicable mostly for fresh water samples. (Author's abstract) W89-03302

DETERMINATION OF TIN IN ENVIRON-MENTAL SAMPLES BY GRAPHITE FURNACE ATOMIC ABSORPTION AND INDUCTIVELY COUPLED PLASMA-MASS SPECTROMETRY,

COUPLED PLASMA-MASS SPECTROMETRY, Toronto Univ. (Ontario). Dept. of Geology. A. Brzezinska-Paudyn, and J. C. van Loon. Fresenius Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 331, No. 7, p 707-712, August 1988. 3 fig, 8 tab, 15 ref. National Science and Engineering Research Council Canada grant no. A2689 and the Ontario Ministry of the Environment project no. 207RR.

Descriptors: *Pollutant identification, *Tin, *Tissue analysis, *Water analysis, *Spectroscopy, Atomic absorption spectrophotometry, Inductively coupled plasma-mass spectrophotometry.

Methods for the determination of total tin in environmental samples (waters, animal tissue, plant material, sediments and coal fly ash), by graphite furnace absorption spectrometry and inductively coupled plasma-mass spectrometry have been developed. Noble metals (Ag, Au, Pd, Pr, Rh) were studied under reducing conditions as matrix modifiers for the determination of tin by graphite furnace absorption spectrometry. The maximum ashing temperature (1400 C), highest sensitivity, and the best absolute detection limit (4 pg) were achieved when Pd was used in the presence of achieved when Pd was used in the presence of hydroxylamine hydrochloride. The achievable senhydroxylamine hydrochloride. The achievable sensitivity depended strongly on the chemical composition of the matrix. Both graphite furnace absorption spectrometry and inductively coupled plasmass spectrometry appeared to be equally sensitive techniques for the direct determination of tin in waters, though inductively coupled plasma-mass spectrometry was a more convenient and sensitive technique for the determination of tin in digested biological and geological materials. (Author's abstract) W89-03303

ACUTE TOXICITY AND BEHAVIORAL EF-FECTS OF ACRYLATES AND METHACRY-LATES TO JUVENILE FATHEAD MINNOWS, Environmental Research Lab.-Duluth, MN For primary bibliographic entry see Field 5C. W89-03313

PESTICIDES IN FISH TISSUE AND WATER FROM TUTTLE CREEK LAKE, KANSAS, Kansas Dept. of Health and Environment, Topeka. Div. of Environment. For primary bibliographic entry see Field 5B. W89-03317

COMPARISON OF FLOW-THROUGH AND TOWED FLUOROMETERS FOR MEASURING OIL CONCENTRATIONS IN THE SEA. Warren Spring Lab., Stevenage (England). N. Hurford, I. Buchanan, R. J. Law, and P. M.

Available from the National Technical Information Service, Springfield, VA 22161, as PB88-202973. Price codes: E04 in paper copy, E04 in microfiche. 13p, 5 fig, 2 tab, 6 ref.

Descriptors: *Oil spills, *Monitoring, *Path of pol-lutants, *Water quality control, *Oil pollution, Fluorometry, Oil slicks, Fate of pollutants, Water

A comparison is made between two techniques for the continuous measurement of subsurface concentrations of oil; one using a flow-through fluorome-

Sources Of Pollution—Group 5B

ter and the other a towed, submersible fluorometer and the other a towed, submersible fluorometer. The performance of the two instruments was compared during a field trial carried out by Warren Spring Laboratory and the Fisheries Laboratory. Both instruments were found to give very similar outputs beneath both non-dispersed and chemically dispersed oil slicks. The trial showed that the choice of instrument wi. 2 dependent on the intended application. The flow-through fluorometer is the preferred instrument for measuring concentrations beneath experimental oil spills whereas the towed fluorometer is more suitable for water anality studies (Author's abstract). water quality studies. (Author's abstract) W89-03329

5B. Sources Of Pollution

FATE OF 4,6-DINITRO-O-CRESOL IN MUNIC-IPAL ACTIVATED SLUDGE SYSTEMS, Environmental Protection Service, Burlington (Ontario). Waste Water Technology Centre. For primary bibliographic entry see Field 5D. W89-02296

EFFECTS OF ATMOSPHERIC POLLUTANTS ON FORESTS, WETLANDS AND AGRICULTURAL ECOSYSTEMS.

IURAL ECUSYSTEMS, Springer-Verlag, New York. Proceedings of the NATO Advanced Research Workshop on Effects of Acidic Deposition on Forests, Wetlands, and Agricultural Ecosystems held at Toronto, Canada, May 12-17, 1987. 652p. Edited by T.C. Hutchinson and K. M. Meema.

Descriptors: *Water pollution sources, *Acid rain, *Air pollution, *Water pollution sources, *Chemistry of precipition, *Forests, *Wetlands, *Air pollution effects, Sulfur dioxide, Ozone, Fog. Particulate matter, Heavy metals, Soil chemistry, Soil contamination, Peat soils.

The purpose of the NATO Advanced Research Workshop, Toronto, Canada, 1985, was to provide 'state of the art' reports on knowledge of the sensitivities and responses of forests, wetlands and crops to airborne pollutants. These pollutants included acidic deposition, heavy metal particulates, sulfur dioxide, ozone, nitrogen oxides, acid fogs and mixtures of these. The objective of the working groups of the Workshop was to provide written statements of consensus of what is known, what is unknown, and what needs to be known in the following areas: (1) the responses of forests to airborne pollutants, with particular consideration of the possible role of air pollutants in the problem of forest decline and tree dieback now occurring widely in Europe, uplands of eastern U.S., and the widely in Europe, uplands of eastern U.S., and the sugar maple-dominated forests of Quebec, Ontario and New Brunswick, Canada; (2) the responses of soils and soil microbial populations to atmospheric soils and soil microbial populations to atmospheric inputs, especially acidic pollutants, as well as the nature and chemistry of soil acidification processes; (3) the responses of crop plants and agroecosystems to air pollution, especially gaseous pollutants and acid rain; and (4) the response of wetlands and peatlands to atmospheric pollutants, with special consideration of the sensitivity of wetland species to changes in the acidity and chemical status of wet and dry deposition. (See W89-02305 thru W89-02316) (Friedmann-PTT)

CONSEQUENCES OF CLOUD WATER DEPO-SITION ON VEGETATION AT HIGH ELEVA-TION.

Institute of Terrestrial Ecology, Edinburgh (Scotland). M. H. Unsworth, and A. Crossley.

M. H. Chisworth, and A. Crossley. In: Effects of Atmospheric Pollutants on Forests, Wetlands, and Agricultural Ecosystems. Springer-Verlag, New York. 1987. p 171-188, 3 fig, 4 tab, 52

Descriptors: *Air pollution, *Cloud liquid water, *Path of pollutants, *Acid rain, *Fog, *Vegetation effects, *Atmospheric physics, Model studies, Rain, Leaves, Forests.

The capture of wind-driven cloud by vegetation provides a pathway for pollutant deposition that

has only recently been identified, and remains only poorly quantified. Current knowledge of three as-pects of the pathway are reviewed: measurement and modeling of the rates of deposition of cloud water to various vegetation types; techniques for monitoring the concentrations of soluble and solid water to various vegetation types; techniques for monitoring the concentrations of soluble and solid material in cloudwater; and potential mechanisms for injury to vegetation by the deposited material. Although there have been many measurements of amount of fog drip below trees, there are very few where there is sufficient detail of the environmental conditions and plant structure to allow generalizations to be drawn. Analysis of existing measurements supports the view that fog-water fluxes are essentially limited only by rates of turbulent transfer and so can be modeled realistically from a knowledge of momentum transfer. This can be shown to imply that fog-water fluxes are typically 1 mg/sq m/s over short grass and 10 mg/sq m/s over forests. Analysis of drag forces on leaves and shoots can be used to show that isolated trees and shrubs capture fog water at rates of up to 100 mg/sq m/s, consistent with the few useful observations. These analyses suggest that there is substantial spatial variation in fog-water deposition, for example at the upwind edges of forests, and on dominant trees in canopies. There will also be large vertical variation in a dense canopy in the amount of water deposited per unit foliage density; current knowledge of in-canopy wind profiles can be used to estimate this. The low pH of cloud water may, by itself, be sufficient to damage foliage, by eroding cuticular waxes and, for example, directly injuring epidermal cells, or allowing increased leaching, or altering gas or water vapor exchange. (See also W89-02304) (Author's abstract) W89-02305

AIR POLLUTION AND SOIL ACIDIFICATION, Norsk Inst. for Skogforskning, Aas.

Norsk Inst. for Skogforskning, Aas. G. Abrahamsen.

IN: Effects of Atmospheric Pollutants on Forests, Wetlands, and Agricultural Ecosystems. Springer-Verlag, New York. 1987. p 321-331, 2 fig. 1 tab. 35

Descriptors: *Air pollution, *Acid rain, *Soil contamination, *Soil chemistry, *Water pollution sources, Chemistry of precipitation, Path of pollut-

Evaluation of the effects of acid deposition on soil acidity can be based on general considerations of acid-producing and acid-consuming processes in the soil, theoretical calculations, reanalyses of soils previously analyzed for soil acidity and experi-ments with artificial acidification. Use of these ments with artificial acidification. Use of these different approaches indicates that many soils exposed to atmospheric acid deposition are likely to become more acidic. However, theoretical considerations, as well as experimental results, show that a fast-growing forest stand has a very significant natural acidifying effect on the soil. In areas with moderate acidic deposition, this effect is likely to override the effect of atmospheric deposition. Interpretation of changes in soil acidity with time is, for this and other reasons, sometimes very difficult. for this and other reasons, sometimes very difficult. However, the conclusion can be drawn that soil acidity of large areas exposed to acid deposition is increasing faster than natural rates of acidification. (See also W89-02304) (Author's abstract) W89-02306

DISCUSSION OF THE CHANGES IN SOIL ACIDITY DUE TO NATURAL PROCESSES AND ACID DEPOSITION, Oak Ridge National Lab., TN. Environmental Sciences Div. D. W. Johnson.

IN: Effects of Atmospheric Pollutants on Forests, Wetlands, and Agricultural Ecosystems. Springer-Verlag, New York. 1987. p 333-345, 3 fig, 44 ref.

Descriptors: *Acid rain, *Soil contamination, *Soil chemistry, *Water pollution sources, *Aluminum, Decomposing organic matter, Cations, Cation exhchange, Seasonal variations, Leaching, Chemistry

The soil acidity capacity factor, as it may be affected by acid deposition as well as a number of other

processes, is discussed. There is little evidence of rapid change in bulk soil acidity due to acid deposition, except where acid inputs are extremely high. Over many decades, soil acidity can be increased due to uptake of base cations by the vegetation, by humus formation, and by natural as well as acid-deposition-enhanced soil leaching wherever annual mean precipitation exceeds mean annual evaporation. The role of acid deposition in accelerating soil acidification rates can be estimated from elemental budget approaches, but the actual changes in soil acidity due to acid deposition are difficult to document because so few studies combine the measurement of element and proton fluxes with long-term periodic remeasurements of soil acidity. Most empirical observations to date show little change in forest soil acidity from any cause in less than 20 to 30 years. However, some increases in exchangeable or soluble Al3+ without concomitant reductions in exchangeable base cations have been noted at the Solling site in West Germany. These Al3+ releases may be due to dissolution of interlayer Al3+ in 2:1 clays. All attempts to monitor long-term changes in soil acidity need to take into account the possibility of seasonal variations due to annual cycling of base-cations by vegetation. The effects of seasonal uptake and return of base cations by vegetation upon the base cation status of surface soils can be considerable and might be confused with long-term trends if not properly accounted for. (See also W89-02304) (Author's abstract) W89-02307

SOIL ACIDIFICATION AND METAL SOLU-BILITY IN FORESTS OF SOUTHERN SWEDEN,

SWEDEN,
Lund Univ. (Sweden). Metal Ecology Group.
G. Tyler, D. Berggren, B. Bergkvist, U.
Falkengren-Grerup, and L. Folkeson.
IN: Effects of Atmospheric Pollutants on Forests,
Wetlands, and Agricultural Ecosystems. SpringerVerlag, New York. 1987. p 347-359, 10 fig, 1 tab, 6

Descriptors: *Leaching, *Weathering, *Water pol-lution sources, *Acid rain, *Soil contamination, *Soil chemistry, *Sweden, *Forest soils, Forests, Hydrogen ion concentration, Solubility, Zinc, Magnesium, Aluminum, Cadmium, Trace elements, Heavy metals, Ecosystems, Deciduous forests, Coniferous forests.

Far-reaching acidification of forest soils has oc-curred in southern Sweden during the last decades. The decreasing pH has, directly or indirectly, in-creased the solubility of several elements in the soil, including magnesium, aluminum, cadmium and zinc. This has resulted in high concentrations and zinc. This has resulted in high concentrations of these elements in the soil-water and a considerably greater output than input from the forest ecosystems. Both deciduous and coniferous forest soils have become acidified but the solubilization and flow of metals is greater in spruce stands than in beech and birch stands on originally similar soil. (See also W89-02304) (Author's abstract) W89-02308

DIFFERENCES IN ALUMINUM MOBILIZA-TION IN SPODOSOLS IN NEW HAMPSHIRE (USA) AND IN THE NETHERLANDS AS A RESULT OF ACID DEPOSITION, Agricultural Univ., Wageningen (Netherlands). Dept. of Soil Science and Geology. J. Mulder, and N. van Breemen. IN: Effects of Atmospharic Pollutants on Exercise

J. Middel, and N. Van Breenen. IN: Effects of Atmospheric Pollutants on Forests, Wetlands, and Agricultural Ecosystems. Springer-Verlag, New York. 1987. p 361-376, 5 tab, 30 ref.

Descriptors: *Leaching, *Weathering, *Water pol-lution sources, *Acid rain, *Soil contamination, *Spodosols, *Aluminum, *Heavy metals, Chemis-try of precipitation, Soil chemistry, Soil water, Sulphate, Silicon, Cation, Soil horizons, Soil or-ganic matter, Path of pollutants, Deposition, Inor-

Aluminum mobilization was studied in two Spodo-sols from the Netherlands (one under forest, and one under heather), and the results compared with

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

Group 58-Sources Of Pollution

aluminum mobilization data for North American Spodosols at the Hubbard Brook Experimental Forest (HBEF), New Hampshire. Annual budgets for aluminum, silica, and sulfate were calculated from measured chemical fluxes in precipitation and from measured chemical fluxes in precipitation and throughfall, soil solution chemistry and estimated soil water fluxes. In the Netherlands, due to canopy entrapment, the forested Spodosol received higher inputs of atmospheric (NH4)2SO4 (1.3 kmol/ha/y) than the heathland Sposodol (0.5 kmol/ha/y). Assimilation of NH4+, the main source of acidity, caused a strong mobilization of aluminum, which resulted in a net removal of Al (as sulfate) from the illuvial B horizon. Soil solutions in the B horizons at both Dutch sites were (as sulfate) from the illuvial B horizon. Soi' solutions in the B horizons at both Dutch sites were slightly undersaturated with natural gibbsite, but reached saturation with jurbanite (A(SO4)(OH)-H2O). Spodosols from New Hampshire (USA) have atmospheric acid inputs similar to the Dutch through basic cation solubilization, and only to a small extent via aluminum solubilization. In the North American podzol B horizons, organic aluminum transport to and inorganic aluminum export from the B horizons at about equal, so there is no net breakdown of this horizon. Soil solutions from the B horizons at HBEF are slightly undersaturated with natural gibbsite and highly undersaturated with natural gibbsite and highly undersaturated with jurbanite. A lower content of weatherable slicate minerals is probably the main cause for the higher levels of dissolved aluminum in the Dutch Spodosols compared to those of HBEF. USA. If this is true, high inorganic aluminum fluxes are expected in North America Spodosols with similar acid inputs but with much lower contents of bases, than at HBEF. (See also W89-02304) (Author's abstract) tions in the B horizons at both Dutch sites were abstract) W89-02309

LIMITS ON CATION LEACHING OF WEAKLY PODZOLIZED FOREST SOILS: AN EMPIRICAL EVALUATION,

Great Lakes Forestry Research Centre, Sault Sainte Marie (Ontario).

I. K. Morrison, and N. W. Foster.

IN: Effects of Atmospheric Pollutants on Forests, Wetlands, and Agricultural Ecosystems. Springer-Verlag, New York. 1987. p 377-385, 1 fig. 4 tab, 22

Descriptors: *Weathering, *Acid rain, *Leaching, *Soil absorption capacity, *Anion exchange, *Soil chemistry, *Forest soils, *Podzols, Adsorption, Water pollution sources, Sand, Pine trees, Soil horizons, Chemical properties, Sulfate.

Chemical properties of two weakly podzolized sandy soils, one a Humo-Ferric Podzol, the other a candinal properties of two wearby poutonized sandy soils, one a Humo-Ferric Podzol, the other a less well-developed Dystric Brunisol, both from beneath mid-aged jack pine (Pinus banksiana Lamb.) stands in northern Ontario, Canada, are given. In a 7 1/2-year-old column-lysimeter experiment (reported elsewhere), it had been noted that both soils, but the Podzol in particular, initially exhibited strong resistance to (SO4)2- leaching. A hypothesis of anion immobilization by (SO-i)2- adsorption was advanced. Data to support the hypotheses are presented on (SO4)2- adsorption characteristics of the two soils. During the initial phase of (SO4)2 loading to these soils, cation leaching is effectively blocked by selective removal of (SO4)2- ions from the leaching solution and their adsorption chiefly into the Bril or Bml horizons, and the leaching solution is thereby robbed of austropholi chieffy into the Bil of Bill Indizons, and the leaching solution is thereby robbed of counterions. Once (SO4)2- adsorption capacity is reached, bases move freely with surplus (SO4)2-ions, with the chief limitation to removal being the upper limit imposed by the supply of exchangeable ions themselves. Evidence suggests that prolonged exposure to acid solutions may result in increased weathering of silicate minerals of sufficient magni-tude to compensate eventually for losses associated with the stripping of exchangeable reserves. (See also W89-02304) (Author's abstract)

NATURAL AND ANTHROPOGENIC ACIDIFI-CATION OF PEATLANDS, Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology. E. Gorham, J. A. Janssens, G. A. Wheeler, and P.

IN: Effects of Atmospheric Pollutants on Forests, Wetlands, and Agricultural Ecosystems. Springer-Verlag, New York. 1987. p 493-512, 11 fig, 2 tab,

Descriptors: *Wetlands, *Acid rain, *Soil contami-nation, *Soil chemistry, *Peat soils, *Acidic water, Hydrogen ion concentration, Ecosystems, Biode-gradation, Mosses, Aquatic animals, Aquatic plants, Organic acids, Fens, Leaching, Nitrates, Sulfates, Water pollution sources.

Peatlands are ubiquitous in northern landscapes, and decomposition of their plant remains produces complex, colored organic acids that acidify their waters and those of the steams and lakes into which they drain. Fens with weakly acid surface waters (pH about 6) and low alkalinity (about 40 ueg/L) are vulnerable to rapid change, and may be acidified by invasion of carpet-forming Sphagnum mosses that bring about major alterations in their biotic communities. The plant communities of such fens include a mixture of species characteristic of both minerotrophic and ombrotrophic peatlands. Because mosses exhibit widely differing pH tolerances, stratigraphic examination of their remains in peat profiles (coupled with dating by various techniques) can reveal anthropogenic and natural acidification of peatlands. Decreasing concentrations of metals upward in peat profiles indicate concurrent impoverishment of lithophile elements (calcium, iron, etc.). Acid deposition falling upon peatlands is largely neutralized (except where unusually heavy) by plant uptake and – beneath the water table—by microbial reduction of associated nitrate and sulfate. Whether fen peats above the water table can be leached sufficiently by acid deposition to initiate or accelerate invasion by Sphagnum and consequent acidification remains to be seen, but is to be expected at least under exceptionally severe conditions of acid loading. (See also W89-02304) Peatlands are ubiquitous in northern landscapes. to be expected at least under exceptionally severe conditions of acid loading. (See also W89-02304) (Author's abstract)

RESPONSES TO ACIDIC DEPOSITION IN OMBOTROPHIC MIRES IN THE U.K.,

Manchester Univ. (England). Dept. of Botany. J. A. Lee, M. C. Press, S. Woodin, and P.

IN: Effects of Atmospheric Pollutants on Forests, Wetlands, and Agricultural Ecosystems. Springer-Verlag, New York. 1987. p 549-560, 5 fig. 31 ref.

Descriptors: *Mires, *Water pollution sources, *Acid rain, *Water pollution effects, *Marshes, *Wetlands, *Air pollution effects, Vegetation effects, Plant physiology, Aquatic plants, Uptake, Nitrogen, Enzymes, Mosses.

Ombrotrophic blanket mires are ecosystems of par-Ombrotrophic blanket mires are ecosystems of particular sensitivity to acidic deposition. The blanket mires of the southern Pennines of England have been extensively modified as the result of atmospheric pollution since the Industrial Revolution. Sphagnum species have virtually disappeared from the area probably as the result of high concentrations of sulfur dioxide or its solution products that were prevalent in the past. The poor growth of present-day transplants into the southern Pennine mire is associated with large increases in tissue nitrogen concentrations, suggesting that nitrogen deposition is of increasing importance, and this is supported by laboratory and field growth experisupported by laboratory and field growth experi-ments. In unpolluted environments, nitrate reduc-tase activity of ombrotropic Sphagnum species in-creases in response to nitrate deposition. However, creases in response to intrate deposition. Nowever, this 'coupling' quickly disappears in the polluted southern Pennines, presumably as the result of the supra-optimal nitrogen supply, and nitrate is no longer retained by the moss. These observations are discussed in relation to the possible effects of increased nitrogen deposition on mires remote from industrial and urban regions. (See also W89-0220) (Authors extracts) 02304) (Author's abstract) W89-02314

STRATIGRAPHIC RECORD OF ATMOSPHER-IC LOADING OF METALS AT THE OMBRO-TROPHIC BIG HEATH BOG, MT. DESERT

ISLAND, MAINE, U.S.A., Maine Univ. at Orono. Dept. of Geological Sci-

S. A. Norton

S. A. NOTION.

IN: Effects of Atmospheric Pollutants on Forests, Wetlands, and Agricultural Ecosystems. Springer-Verlag, New York. 1987. p 561-576, 7 fig, 1 tab, 15 ref. U.S. NSF Grant DEB-7922142.

Descriptors: *Water pollution sources, *Peat bogs, *Acid rain, *Chemistry of precipitation, *Air pollution effects, Heavy metals, Deposition, Calcium, Magnesium, Sodium, Potassium, Iron, Manganese, Aluminum, Titanium, Zinc, Marshes, Vegetation effects, Trees, Bioaccumulation.

A study was undertaken to determine whether or not the chemical stratigraphy of peat bogs reflects atmospheric deposition rates for various energy-related pollutants. Cores from Big Heath, Mount Desert Island, Maine were dated using 210Pb chronology (CRS model) and analyzed for bulk chemistry. Concentration profiles for major elements (Ca, Mg., Na, K, Fe, Mn, Al, and Ti) are consistent for replicate cores from either hollows or hummocks; however, profiles for hummocks and hollows are very different from each other. Neither site yielded concentration profiles related to atmospheric deposition, due to post-depositional processes. Net accumulation rates for major metals are consequently unrelated to atmospheric deposition rates, particularly for biophilic elements such as Ca, K, and Mn. Net accumulation rates of Pb and Zn (largely attributable to atmospheric pollution) crudely mimic those observed in sediments of nearby lakes. However, considerable Zn moves out of the system. Integrated total Pb and 210Pb values for hummork cores as about trains the format of the states. e system. Integrated total Pb and 210Pb for hummock cores are about twice those for hol-lows, suggesting lateral migration of these compo-nents and, by implication, others. (See also W89-02304) (Author's abstract) W89-02315

PROTON CYCLING IN BOGS: GEOGRAPHI-CAL VARIATION IN NORTHEASTERN NORTH AMERICA,

Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
N. R. Urban, S. J. Eisenreich, and E. Gorham

N. R. CUDAII, S. J. EISERFIECH, and E. GOTIAM. IN: Effects of Atmospheric Pollutants on Forests, Wetlands, and Agricultural Ecosystems. Springer-Verlag, New York. 1987. p 577-598, 4 fig, 4 tab, 66 ref. NSF Grant No. DEB 7922142.

Descriptors: *Acid rain, *Marshes, *Soil chemistry, *Hydrogen ion concentration, *Peat soils, Organic compounds, Alkalinity, Soil organic matter, Uptake, Sulfates, Water pollution sources, Chemical properties.

cal properties.

A detailed hydrogen ion budget, constructed for the Marcell bog in north-central Minnesota was based on a 5-year, intensive study of element cycles. Major features of the acidity balance for this site include the following: (1) production of organic acids (263 meq/sq m/y) is the dominant source of acidity and serves to buffer the bog water at pH 4; (2) sequestering of elements in peat is also a significant source of acidity (42.9 meq/sq m/y); (3) weathering of dustfall inputs is an important source of alkalinity (< 76 meq/sq m/y) at this site, which is situated near the major agricultural areas of the plains; (4) nitrate and sulfate reduction contribute little alkalinity (< 39.2 meq/sq m/y) because inputs (NO3 and SO4) to this bog are low. Analysis of peat and surface water from bogs across northeastern North America (Manitoba to Newfoundland) reveals the following: (1) production of organic acids across this region varies between 104 and 263 meq/sq m/y; (2) acidity-generation associated with net biological uptake (NBU, excluding nitrogen = 20-117 meq/sq m/y) varies in proportion to the rate of peat accumulation; (3) nBU-acidity exhibits high values in maritime bogs and lower values in mid-continental bogs; (4) bogs have a large capacity for sulfate reduction, and sulfate reduction becomes an increasingly important source of alkalinity as rates of sulfate deposition increase. From 60 to 93% of annual sulfate loadings are retained as reduced sulfur in bogs across eastern North America. (See also W89loadings are retained as reduced sulfur in bogs across eastern North America. (See also W89-02304) (Author's abstract)

Sources Of Pollution-Group 5B

COMPARISON OF LAKE SEDIMENTS AND OMBROTROPHIC PEAT DEPOSITS AS LONG-TERM MONITORS OF ATMOSPHERIC

POLLUTION, Maine Univ. at Orono. Dept. of Geological Sci-

For primary bibliographic entry see Field 5A. W89-02321

REVIEW OF THE CRATER LAKE LIMNOLO-GICAL PROGRAMS, Oregon State Univ., Corvallis. Coll. of Forestry. For primary bibliographic entry see Field 2H. W89-02322

GAS CHROMATOGRAPHIC RESIDUE PAT-TERNS OF TOXAPHENE IN FISH SAMPLES FROM THE GREAT LAKES AND FROM RIVERS OF THE SOUTHEASTERN UNITED STATES.

Columbia National Fisheries Research Lab., MO. J. D. Petty, T. R. Schwartz, and D. L. Stalling. IN: New Approaches to Monitoring Aquatic Ecosystems. American Society for Testing and Materials, Philadelphia, PA. 1987. p. 165-172, 2 fig, 3 tab,

Descriptors: "Path of pollutants, "Fish, "Pesticides, "Water analysis, "Toxaphene, "Water quality, "Ecosystems, "Great Lakes, Data collection, Siskiwit Lake, Isle Royale, Principal component analysis, Tissue analysis, Models, United States, Gas chromatography.

Residues of environmentally derived toxaphene Residues of environmentally derived toxaphene were determined in fish samples from the Great Lakes and from rivers of the southeastern United States. These analyses were performed by fused silica capillary gas chromatography with electron capture detection. Data reduction and compilation were performed using an 'in-house' developed data system. An effort was made to more clearly deliverate the similarity of environmentally derived toxages the similarity of environmentally derived toxages. system. An effort was made to more clearly delin-eate the similarity of environmentally derived toxa-phene residues to technical toxaphene. SIMCA, a principal components pattern recognition tech-nique, was used to analyze sample residues. Pro-files of toxaphene residues in the Great Lakes samples are more similar to each other than samsamples are more similar to each other than sam-ples collected from the river systems of the south-eastern United States. The differences in the class models could result from the process of volatiliza-tion and atmospheric transport to the Great Lakes as opposed to soil runoff and chemical alteration by reduction in anaerobic sediments in the southeastern river systems. A majority of the samples differ substantially in composition from the original toxaphene mixture. (See also W89-02317) (Author's abstract) W89-02328

ASSESSMENT OF THE ADEQUACY OF THE GROUND-WATER MONITORING SYSTEM FOR ARTIFICIAL RECHARGE OF AQUIFERS IN THE LOS ANGELES AREA, CALIFORNIA, Western Water Consultants, Inc., Laramie, WY. For primary bibliographic entry see Field 7A. W89-02335

DRY WELLS - SOLUTION OR POLLUTION: AN ARIZONA STATUS REPORT,

Arizona Dept. of Environmental Quality, Phoenix. J. Haney, M. Leach, and L. Sobchak. IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 105-128, 6 fig. 3 tab, 16 ref.

Descriptors: *Artificial recharge, *Wastewater disposal, *Dry wells, *Arizona, *Water pollution sources, *Drainage systems, *Groundwater pollution, *Urban runoff, Urban watersheds, Flood control, Groundwater recharge, Groundwater management, Groundwater monitoring, Aquifers, Hydrology, Geohydrology, Water law, Storm runoff, Path of pollutants, Water resources development.

Dry wells are used extensively in Arizona for on site disposal of stormwater, and, in certain industrial areas, have been documented as providing a

conduit to groundwater for contaminated runoff and other wastes. With Arizona's rapid growth stretching municipal capitol resources, cities are requiring new commercial developments to pro-vide on site retention of stormwater. The use of vide on site retention of stormwater. The use of dry wells in retention basins is offen the preferred alternative for providing drainage of retained water within the required time limits, thereby re-ducing health problems associated with mosquito borne encephalitis. In addition to flood control, dry well disposal of urban runoff may provide groundwater recharge. It is estimated that 200 dry dry well disposal of urban runoff may provide groundwater recharge. It is estimated that 200 dry wells a month are currently being installed in the Phoenix area due to city and county ordinances. Dry wells typically contain an upper settling chamber and lower gravel fill and are 30 to 70 feet deep. The majority of dry wells in Arizona do not reach groundwater. Attenuation of water borne pollutants in the vadose zone is related to the degree of exposure of drainage water to soil particle surfaces. Dry wells reduce the potential for attenuation of contaminants by decreasing the travel distance to groundwater. Dry wells mad sloc ut through low permeability zones that would otherwise increase pollutant attenuation. Fifteen sites have been documented in Arizona with groundwater contamination that can be directly related to dry wells. Concern over dry wells as a source of groundwater pollution in Arizona has led to state legislation requiring registration of existing and new dry wells and licensing of dry well drillers. This legislation gives the state authority to adopt rules regarding locational, operational, and closure standards for new and existing dry wells. (See also W89-02331) (Author's abstract) W89-02338

FIELD SIMULATION OF WASTE IMPOUND-MENT SEEPAGE IN THE VADOSE ZONE, New Mexico Inst. of Mining and Technology, Socorro-Dept. of Geoscience. A. M. Parsons, E. D. Mattson, D. B. Stephens, K. Black and K. Flanieso.

A. M. Parsons, E. D. Mattson, D. B. Stephens, K. Black, and K. Flanigan.
IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 313-335, 11 fig, 2 tab, 17 ref.

Descriptors: *Landfills, *Path of pollutants, *Water pollution sources, *Solute transport, *Groundwater monitoring, *Groundwater pollution, *Model studies, Simulation, Field tests, Calibrations, Aquifers, Prediction, Hydrology, Geohydrology, Infiltration, Hydraulic conductivity, Soil profiles, Physical properties, Geophysics, Rainfall simulators, Measuring instruments, Waste disposal.

In arid and semi-arid climates, depth to the water table may be 10's of meters below the land surface. Surface impoundments, landfills, mill tailings piles, and underground storage tanks may leak effluent through the vadose zone that may reach the water table. Groundwater hydrologists have used numerical simulations to predict the direction and rate of ical simulations to predict the direction and rate of contaminant seepage in the vadose zone. However, none of the current models have been validated by actual field data to test the accuracy of their predictions. A controlled unsaturated field experiment was conducted to simulate seepage through a lined impoundment. Water was applied through a drip irrigation system at a flux rate of 0.00001 cm/sec over a 10m x 10m surface. The seepage rate is irrigation system at a flux rate of 0.00001 cm/sec over a 10m x 10m surface. The seepage rate is roughly 100-fold less than the saturated hydraulic conductivity of the soil. The soil profile is strati-fied, consisting of fluvial sand underlying alluvial silty sand deposits. Wetting front movement was monitored with neutron logging equipment and tensiometers. After 80 days the wetting front has progressed 7 meters vertically and 2 to 3 meters laterally away from the edge of the drip system. It is inferred that natural soil stratification and effec-tive anisotropy of unsaturated hydraulic conductive anisotropy of unsaturated hydraulic conduc-tivity tend to inhibit the downward movement of tivity tend to inhibit the downward movement of seepage. This field experiment has been in progress for > six months and data continue to be collect-ed. The predictive abilities of analytical solutions to the linearized moisture flow equation to predict the wetting front location in a layered soil profile were demonstrated. It is planned to use the exten-sive data base will to validate multi-dimensional numerical models of saturated-unsaturated flow at a field scale. (See also W89-02331) (Author's ab-stract)

W89-02348

APPLYING ELECTRICAL RESISTANCE BLOCKS FOR UNSATURATED ZONE MONI-TORING AT ARID SITES,

EMCON Associates, San Jose, CA. For primary bibliographic entry see Field 7B. W89-02352

MODELING OF POLYCHLORINATED BI-PHENYLS IN VADOSE ZONE, Weston (Roy F.), Inc., West Chester, PA.

weston (ROy F.), Inc., West Chester, PA.
J. Y. Yang.
IN: Proceedings of the FOCUS Conference on
Southwestern Ground Water Issues. National
Water Well Association, Dublin, OH. 1988. p 397412, 3 tab, 23 ref.

Descriptors: *Soil water pollution, *Vadose zone, *Model studies, *Path of pollutants, *Polychlorinated biphenyls, Simulation, Mathematical studies, Leaching, Aquifers, Solute transport.

Potential groundwater contamination by leaching of polychlorinated biphenyls (PCBs) is recognized as a major environmental issue in the southwestern United States. The EPA romulgated the PCBs spill cleanup policy under the Toxic Substances Control Act in April 1987. This policy requires cleanup of PCBs to different levels depending upon spill location, initial concentration of the PCBs spilled, potential for exposure to residual PCBs remaining PCBs to different levels depending upon spill location, initial concentration of the PCBs spilled, potential for exposure to residual PCBs remaining after cleanup, and the size of the population potentially at risk of exposure. The Seasonal Soil Compartment (SESOIL) model was employed in simulating PCBs movement in the unsaturated soil system within and below the plant root zone. The model was applied at a Texas site to simulate physical and chemical mechanisms affecting the fate of seven PCBs Aroclors (Aroclors 1016, 1221, 1232, 1242, 1248, 1254 and 1260) released into a soil column under varying depths of covering soil, and under varying groundwater depths of 3 and 10 meters. Modeling results indicate that: for a moderate climate, a silty clay loam soil, and a 20-year period following PCBs release into the soil column, adsorption on the soil accounts for release of 67% to 100% of the initial mass: degradation accounts for 0.02% to 30%; PCBs remaining in soil air and soil moisture account for 0 to 0.4%; and leaching to groundwater accounts for 0 to 0.03%. Results also show that the maximum leaching rate for a 20-year period increases approximately 4.5 times for Aroclors 1248, as groundwater depth decreases. (See also W89-02331) (Author's abstract)
W89-02353 stract) W89-02353

MODELING ACID MIGRATION THROUGH

MODELING ACID MIGRATION THROCOS SOILS, New Mexico Univ., Albuquerque. K. J. Partin, D. M. Smith, and B. M. Thomson. IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 547-558, 12 fig, 2 ref.

Descriptors: *Dispersion, *Advection, *Mine wastes, *Model studies, *Acidic water, *Ground-water pollution, *Path of pollutants, Mathematical studies, Statistical methods, Hydrogen ion concentration, Prediction, Chemical reactions, Simulation, Acuifers, Adversarion Aquifers, Adsorption.

A common method of disposal of strongly acidic tailings from mining and milling operations is the use of surface detention ponds. Since many of the ponds are not lined, seepage of acid solutions can occur. The purpose of this research is to predict and describe acid migration through soils. The migration of the acid through the soil can be described by the one-dimensional advection-dispersion equation for flow through porcos media. This equation has been modified for acidic solutions using a log transformation, which reduces the variable range up to five orders of magnitude as well as linearizes most source terms. The source term is

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B-Sources Of Pollution

approximated by adsorption isotherms which account for reactions within the soil and can include possible precipitation reactions. A numerical technique using the method of lines with cubic hermite polynomials is used to solve the transport equation. For the case of linear adsorption, excellent agreement between the numerical and analytical results has been generated. Using a soil column, experimental profiles of pH as a function of time have been collected to test the validity of the acid migration model. (See also W89-02331) (Author's abstract)

HYDROGEOLOGIC AND GEOCHEMICAL AS-PECTS OF CONTAMINANT TRANSPORT AT THE FALLS CITY, TEXAS UMTRA SITE,

THE FALLS CITY, TEXAS UMTRA SITE, Weston (Roy F.), Inc., Albuquerque, NM. H. C. Bryson, K. Bostick, and P. Longmire. IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p. 559-577, 12 fig. 2 tab, 12 ref. DOE Contract No. DE-AC04-82AL14086.

Descriptors: *Acid mine drainage, *Water pollution sources, *Uranium, *Mine wastes, *Model studies, *Groundwater pollution, *Path of pollutants, Water quality, Aquifers, Geohydrology, Hydrology, Heavy metals, Chemical reactions, Hydrogen ion concentration from Suffers More and the Control of the Control o drogen ion concentration, Iron, Sulfates, Manga-nese, Molybdenum, Radium.

Groundwater contamination at a former uranium processing site near Falls City, Texas has been investigated under the U.S. Department of Energy's Uranium Mill Tailings Remedial Action (UMTRA) Project. The unconfined Deweesville/Conquista aquifer occurs within the upper 70 fo fine-grained sediments beneath the site and is naturally uraniferous and high in dissolved solids. Acticlic seepage from six tailings piles and one pond at the site has resulted in concentrations of chloride, iron, manganese, molybdenum, radium, sulride, iron, manganese, molybdenum, radium, sulfate, TDS, and uranium that are highly elevated fate, TDS, and uranium that are highly elevated above EPA water quality standards within the shallow aquifer. Nonreactive solutes and heavy metals have migrated > 2500 feet downgradient of the tailings piles within a low-pH contaminant plume. Geochemical modeling with WATEQFC predicts that uranium and molybdenum occur as anionic complexes that may be adsorbed onto aquifer materials at low pH values. Saturation indices calculated by WATEQFC predict that mineral precipitation may reduce concentrations of iron precipitation may reduce concentrations of iron, radium, and sulfate in contaminated groundwater beneath the site. (See also W89-02331) (Author's abstract) W89-02362

NATIONAL SURFACE WATER SURVEY, WESTERN LAKE SURVEY (PHASE I – SYN-OPTIC CHEMISTRY) QUALITY ASSURANCE

Lockheed Engineering and Management Services Co., Inc., Las Vegas, NV. For primary bibliographic entry see Field 2H. W89-02413

DESIGN OF A GREAT LAKES ATMOSPHERIC INPUTS AND SOURCES (GLAIS) NETWORK, De Paul Univ., Chicago, II.. For primary bibliographic entry see Field 7A. W89-02418

ESTIMATING THE TRANSPORT AND DEPO-SITION OF MINING WASTE AT OK TEDI, Ok Tedi Mining Ltd., Port Moresby (Papua New

nary bibliographic entry see Field 2J.

EXTERNAL QUALITY-ASSURANCE RESULTS FOR THE NATIONAL ATMOSPHERIC DEPO-SITION PROGRAM AND NATIONAL TRENDS NETWORK DURING 1986,

Geological Survey, Denver, CO. Water Resources

For primary bibliographic entry see Field 7C. W89-02463

WATER QUALITY DATA FOR THE BOISE RIVER, BOISE TO STAR, IDAHO, OCTOBER TO DECEMBER 1987, Geological Survey, Boise, ID. Water Resources

For primary bibliographic entry see Field 5C.

PREDICTING CHEMICAL MOVEMENT IN

New Mexico State Univ., Las Cruces. Dept. of Crop and Soil Sciences.
G. A. O'Connor, and F. Khorsandi.

G. A. O'Connor, and F. Knorsand.
Available from the National Technical Information
Service, Springfield, VA 22161, as PB87-203537/
AS. Price codes: A03 in paper copy; A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces. Technical Completion Report
No. M17. August 1986. 25p, 3 ref. State Project

Descriptors: *Computer model, *Solute transport, *Path of pollutants, Model testing, New Mexico, Water pollution sources.

Chemical Movement in Soil (CMIS) is a manage-ment/educational computer model that provides qualitative predictions of pesticide fate as a func-tion of key soil, chemical, and climatic variables. Model assumptions limit it to nonpolar pesticides (and other xenobiotics) moving in sandy soils. The purpose of this work was to test and modify the model for chemicals and soils pertinent to New Mexico. Laboratory column studies with a sandy New Mexico soil matched reasonably well with model predictions. The data suggest that the model could be used as first approximations of resticide could be used as first approximations of pesticide behavior in New Mexico soils. It is primarily useful behavior in New Mexico soils. It is primarily useriu as an educational instrument for students and extension personnel examining implications of various management practices in worst-case scenarios. (O'Connor-NM St. Univ.) W89-02473

HYDROLOGY OF AREA 27, EASTERN REGION, INTERIOR COAL PROVINCE, ILLI-

Geological Survey, Urbana, IL. Water Resources E. F. Zuehls

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Open-File Report 84-707, 1987. 62p, 46 fig, 21 tab,

Descriptors: *Coal, *Coal mines, *Water pollution sources, *Illinois, *Coal hydrology, Hydrologic data, Hydrologic assessment, Water data.

The Eastern Region of the Interior Coal Province is divided into 11 hydrologic reporting areas. Area 27 is located in west-central Illinois and includes the lower Illinois River (below Beardstown), Bear Creek, and Cahokia Creek drainage basins, an area of 5,805 square miles. Glacial till underlies 5 to 15 or 3,800 square miles. Glacial till underlies 3 to 15 feet of loess in the area. The Pennsylvanian System, underlying about two thirds of the area, consists of sandstone, limestone, siltstone, shale, clay, and coal. Two underground mines and one surface mine were in operation as of December 1982. Land subsidence from past underground mining has occurred at seven communities in Macounin and Madison Counties Streamflow and coupin and Madison Counties. Streamflow and water quality data were collected at a network of water quainty data were confected at a network of 38 hydrologic monitoring stations operated by the U.S. Geological Survey and analyzed for specific conductance, pH, alkalinity, dissolved sulfate, total recoverable and dissolved iron and manganese, dissolved solids, and other properties and constituents. Equations were developed to estimate streamflow at ungaged sites and to estimate the dissolved solids concentration from measurements of specific conductance. Groundwater is obtained from both unconsolidated and bedrock aquifers in almost all

ASSESSMENT OF WATER QUALITY AND FACTORS AFFECTING DISSOLVED OXYGEN IN THE SANGAMON RIVER, DECATUR TO RIVERTON, ILLINOIS, SUMMER 1982,

Geological Survey, Urbana, IL. Water Resources

A. R. Schmidt, and J. K. Stamer. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 87-4024, 1987. 65p, 29 fig, 10 tab, 18 ref.

Descriptors: *Water quality, *Computer models, *Dissolved oxygen, *Illinois, *Sangamon River, Path of pollutants, Simulation analysis, Mathematical models, Model studies.

cal models, Model studies.

Water quality and processes that affect the dissolved-oxygen concentration in a 45.9 mile reach of the Sangamon River from Decatur to Riverton, Illinois, were determined from data collected during low-flow periods in the summer of 1982. Relations among dissolved oxygen, water discharge, biochemical oxygen demand, ammonia and nitrite plus nitrate concentrations, and photosynthetic-oxygen production were simulated using a one-dimensional, steady-state computer model. Average dissolved oxygen concentrations ranged from 8.0 milligrams per liter at the upstream end of the study reach at Decatur to 5.2 milligrams per liter at the mouth of Stevens Creek (2.6 miles downstream from Decatury to 0.03 milligram per liter at the downstream end of the study reach. Un-ionized ammonia concentrations exceeded the maximum concentration specified in the State water quality standard (0.04 milligram per liter) throughout most of the study reach. Model simulations indicated that oxidation of ammonia to form nitrite plus nitrate was the most significant process leading to low dissolved oxygen concentrations in the river. (USGS) low diss (USGS) W89-02486

EFFECTS OF ORGANIC WASTES FROM PROCESSING OF GREEN RIVER FORMATION OIL SHALE ON WATER QUALITY,

Geological Survey, Lakewood, CO. Water Resources Div.

J. A. Leenheer, and T. I. Noves Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Professional Paper 1338, 1986. 56p, 36 fig, 24 tab, 57 ref.

Descriptors: *Water pollution effects, *Water pol-lution sources, *Oil shale, *Wastewater disposal, *Water quality, Organic wastes, Water analysis, Soil analysis, Green River Formation, Oil shale

A series of investigations were conducted during a 6-year research project to determine the nature and effects of organic wastes from processing of Green River Formation oil shale on water quality. Green River Formation oil shale on water quality. Fifty percent of the organic compounds in two retort wastewaters were identified as various aromatic amines, mono- and dicarboxylic acids phenols, amides, alcohols, ketones, nitriles, and hydroxypyridines. Spent shales with carbonaceous coatings were found to have good sorbent properties for organic constituents of retort wastewaters. However, soils sampled adjacent to an in situ retort had only fair sorbent properties for organic constituents or retort wastewater, and application retort had only har soroent properties for organic constituents or retort wastewater, and application of retort wastewater caused disruption of soil structure characteristics and extracted soil organic matter constituents. Microbiological degradation of organic solutes in retort wastewaters was found to occur preferentially in hydrocarbons and fatty acid groups of compounds. Aromatic amines did not degrade and they inhibited bacterial growth where their concentrations were significant. Am-monia, aromatic amines, and thiocyanate persisted in groundwater contaminated by in situ oil shale retorting, but thiosulfate was quantitatively de-graded one year after the burn. Thiocyanate was found to be the best conservative tracer for retort water discharged into groundwater. Natural or-ganic solutes, isolated from groundwater in contact with Green River Formation oil shale and from the White River near Rangely, Colorado, were

readily distinguished from organic constituents in retort wastewaters by molecular weight and chemical characteristic differences. (USGS)
W89-02487

HYDROLOGY OF AREA 40, WESTERN REGION, INTERIOR COAL PROVINCE, KANSAS, OKLAHOMA AND MISSOURI, Geological Survey, Lawrence, KS. Water Resources Div. For primary bibliographic entry see Field 4C. W89-02488

DOCUMENTATION FOR A DIGITAL COM-PUTER MODEL OF NUTRIENT AND DIS-SOLVED-OXYGEN TRANSPORT IN THE TRUCKEE RIVER AND TRUCKEE CANAL DOWNSTREAM FROM RENO, NEVADA. Geological Survey, Carson City, NV.

Sources Div.

J. O. Nowlin.

Available from OFSS, USGS, Box 25425, Denver,
CO 80225. USGS Open-File Report 87-554, 1987.

181p, 1 fig. 1 tab, 19 ref.

Descriptors: *Water quality, *Model studies, *Computer programs, *Nevada, *Truckee River, Dissolved oxygen, Path of pollutants, Water pollu-

A digital water quality model was constructed as A digital water quanty model was constructed as part of a water quality assessment of the Truckee River downstream from Reno. This report pro-vides documentation on the computer code and the principal data sets used in model calibration, verification, and simulation. (USGS) W89-02504

HYDROLOGY OF AREA 31, EASTERN REGION, INTERIOR COAL PROVINCE, ILLI-NOIS AND INDIANA, Geological Survey, Urbana, IL. Water Resources

E. E. Zuehls

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report Open-File Report 85-342, 1987. 61p, 47 fig, 21 tab, 50 ref.

Descriptors: *Hydrologic data, *Water quality, *Groundwater, *Surface water, *Coal mines, *Geohydrology, *Illinois, *Coal hydrology, Water pollution sources, Flow characteristics, Soil classification, Water data sources.

Area 31 is located in southeastern Illinois and southwestern Indiana in the Eastern Region of the Interior Coal Province. It includes the lower Wabash River and the Little Wabash River drainage basins (about 4,500 square miles). Thin glacial till underlies 5 to 15 feet of loess and overlies Pennsylvanian rocks. Coal makes up from 1 to 2 cui underlies 5 to 15 feet of loess and overlies Pennsylvanian rocks. Coal makes up from 1 to 2 percent of these rocks. The only operational coal mine, as of December 1983, removed about 2.5 million tons of coal from a depth of about 700 feet in 1982. Streamflow and water quality data were collected from 33 hydrologic monitoring sites operated by the U.S. Geological Survey. Equations were developed to estimate average, high, and peak stream discharge based on drainage area and stream channel slope. The 7-day, 5-year low flow is zero for drainage areas of less than 240 square miles. Water samples were analyzed for specific conductance, pH, alkalinity, dissolved sulfate, total-recoverable and dissolved iron and manganese, dissolved solids, and other properties and constituents. Specific conductance values ranges from 120 to 2,200 microsiemens per centimeter at 25 degrees Celsius. Groundwater is available from unconsolidated and bedrock aquifers; water in the deep bedrock aquifers is highly mineralized. (USGS) W89-02508

RELATION OF WATER CHEMISTRY OF THE EDWARDS AQUIFER TO HYDROGEOLOGY AND LAND USE, SAN ANTONIO REGION, TEXAS

Geological Survey, Austin, TX. Water Resources

Div. P. M. Buzska.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 87-4116, 1987. 100p, 24 fig, 16 tab, 44 ref.

Descriptors: *Groundwater quality, *Land use, *Geohydrology, *Texas, *San Antonio region, *Edwards aquifer, Trace elements, Zinc, Lead, Nutrients, Bacteria, Volatile organic compounds, Fatty acids, Pesticides, Statistical analysis.

Fatty acids, Pesticides, Statistical analysis.

Water-chemistry data from the Edwards aquifer, Texas, for 1976-85, consisting of nearly 1,500 chemical analyses from 280 wells and 3 springs, were used to statistically evaluate relations among groundwater chemistry, hydrogeology, and land use. Five land uses associated with sampled wells were classified from published information and field surveys. Four major subareas of the aquifer were defined to reflect relative susceptibility of groundwater to contaminated originating from human activities using hydrogeologic and tritium data. Water from an agricultural area over the unconfined zone had the greatest median concentration of nitrite plus nitrate. Larger nitrite plus nitrate concentrations were spatially associated with large tritium concentrations and nitrogen isotopic ratios characteristic of streamflow recharge. Detections of fecal coliform bacteria were associated mainly with water from wells completed in the unconfined zone. Most occurrences of tetrachloroethylene, 1,2-(trans)-dichloroethylene, trichloroethulene, 1,1,1-trichloroethane, and 2,4-D in fluoromethane, 1,1,1-trichloroethane, and 2,4D in water were associated with wells completed in the water were associated with wells completed in the unconfined zone of the aquifer. The percentage of samples in which arsenic, barium, lead, and zinc were detected was similar among subareas; the samples were from the freshwater parts of the aquifer. Large lead and zinc concentrations were associated with sampling pumpage less than 1,000 gallons. (USGS) W89-02514

SUPPLEMENTAL ARSENIC DATA FOR SE-LECTED STREAMS IN THE MISSOURI RIVER BASIN, MONTANA, 1987, Geological Survey, Helena, MT. Water Resources

J. R. Knapton, and T. M. Brosten.

A vailable from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-697, 1987. 14p, 5 fig, 3 tab, 7 ref.

Descriptors: *Arsenic, *Water quality, *Geothermal water, *Water pollution sources, *Montana, Streamflow, Missouri River basin.

Geothermal waters within Yellowstone National Park contribute arsenic to the Madison River. Concentrations ranging from 200 to 300 micro-grams per liter in the Madison River near the park boundary are diluted downstream by tributary in-flows to the Madison and Missouri Rivers. Howevflows to the Madison and Missouri Rivers. However, significant amount of arsenic are present in the water of the Missouri River as it enter Fort Peck Lake. A monitoring network of 24 stations was operated during 1985 and 1986 in the upper Missouri River basin to measure arsenic concentrations and arsenic discharges. Additional monitoring at nine stations was conducted during March to July 1987 to supplement the data base. This report presents data acquired from the 1987 monitoring period. (USGS) period. (USGS) W89-02516

EFFECTS OF RUNOFF CONTROLS ON THE QUANTITY AND QUALITY OF URBAN RUNOFF AT TWO LOCATIONS IN AUSTIN,

Geological Survey, Austin, TX. Water Resources

C. T. Welborn, and J. E. Veenhuis. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 87-4004, 1987. 101p, 51 fig. 14 tab, 13 ref.

Descriptors: *Urban runoff, *Water pollution sources, *Path of pollutants, *Texas, *Water pollu-tion control, *Detention ponds, *Travis County. Sources Of Pollution-Group 5B

Rapid urban development in the Austin metropolitan area, Texas, is causing concern about increasing peak discharges from stream runoff and the degradation of the quality of water in receiving streams, lakes, and aquifers. In an attempt to reduce peak discharges and improve water quality runoff controls are being required in certain watersheds. This report summarizes the precipitation, streamflow, and water quality data collected from September 1982 to September 1984 upstream and downstream from runoff controls at two locations, and presents the effects of these runoff controls on streamflow and the quality of runoff water. The runoff controls at the two locations are a detention and filtering pond near Barton Creek Square Shopping Center, a large shopping center located southwest of downtown Austin, and a grass-covered swale control in the Alta Vista Planned Unit Development, a multiple-family housing area. Data indicate that as a result of the Barton Creek Square Shopping Center detention and filtering pond, peak discharges were reduced and peak concentration and loads of most of the analyzed constituents were reduced. However, the grass-covered swale control had tittle effect on reducing the peak discontrol had tittle effect on reducing the peak discontrol had title effect on reducing the peak discontrol had to the control had title effect on reducing the peak discontrol had the discontrol had the effect on reducing the peak discontrol had the discontrol had the effect on reducing the peak discontrol had the effect of the effect were reduced. However, the grass-covered swale control had little effect on reducing the peak dis-charges and peak concentrations at the Alta Vista Planned Unit Development. (USGS)

DATA-COLLECTION METHODS AND DATA SUMMARY FOR THE ASSESSMENT OF WATER QUALITY IN CEDAR CREEK, WEST-CENTRAL ILLINOIS,

Geological Survey, Urbana, IL. Water Resources Div.

For primary bibliographic entry see Field 7B. W89-02520

HYDROLOGY AND WATER QUALITY AT THE WELDON SPRING RADIOACTIVE WASTE-DISPOSAL SITES, ST. CHARLES COUNTY, MISSOURI, Geological Survey, Rolla, MO. Water Resources

M. J. Kleeschulte, and L. F. Emmett.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 87-4169, 1987. 65p, 20 fig, 4 tab, 42 ref.

Descriptors: *Radioactive wastes, *Groundwater pollution, Uranium, Missouri, Water pollution sources, Path of pollutants.

Water samples from five monitoring wells adjacent to raffinate pits storing low-level radioactive waste contained concentrations of nitrate as nitroger ranging from 53 to 990 milligrams per liter. Most ranging from 53 to 990 milligrams per liter. Most samples also had maximum concentrations of calcium (900 milligrams per liter), sodium (340 milligrams per liter), sulfate (320 milligrams per liter), tithium (1,700 micrograms), strontium (1,900 micrograms) per liter). The raffinate pits also had large concentrations of these constituents. A water balance made on the raffinate pits indicated a 0.04 to 0.08 mich per day decrease in the water level that made on the rattinate pits indicated a 0.04 to 0.08 inch per day decrease in the water level that cannot be attributed to meterological conditions. These data and essimically-detected areas of saturated overburden beneath one raffinate pit and possibly adjacent to three other pits indicate leakage from the pits. (USGS) W89-02528

SELECTED WATER-QUALITY DATA FOR THE MURTAUGH LAKE AREA, SOUTH CEN-TRAL IDAHO, JUNE 1987,

Geological Survey, Boise, ID. Water Resources For primary bibliographic entry see Field 7C.

W89-02530

DATA ON GROUNDWATER QUALITY FOR THE MILLETT 1 DEGREE X 2 DEGREE QUADRANGLE, CENTRAL NEVADA, Geological Survey, Carson City, NV. Water Resources Div.

For primary bibliographic entry see Field 7C. W89-02533

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B-Sources Of Pollution

DATA ON GROUNDWATER QUALITY FOR THE ELKO 1 DEGREE X 2 DEGREE QUAD-RANGLE, EASTERN NEVADA, Geological Survey, Carson City, NV. Water Re-

For primary bibliographic entry see Field 7C. W89-02534

DATA ON GROUNDWATER QUALITY FOR THE ELY 1 DEGREE X 2 DEGREE QUADRAN-GLE, EASTERN NEVADA, Geological Survey, Carson City, NV. Water Re-

sources Div. For primary bibliographic entry see Field 7C. W89-02535

DATA ON GROUNDWATER QUALITY FOR THE LUND 1 DEGREE X 2 DEGREE QUAD-RANGLE, EASTERN NEVADA, Geological Survey, Carson City, NV. Water Re-

For primary bibliographic entry see Field 7C. W89-02536

DATA ON GROUNDWATER QUALITY FOR THE MCDERMITT ONE DEGREE X TWO DEGREE QUADRANGLE, NORTHERN

Geological Survey, Carson City, NV. Water Resources Div.

For primary bibliographic entry see Field 7C. W89-02537

DATA ON GROUNDWATER QUALITY FOR THE LOVELOCK ONE DEGREE X TWO DEGREE QUADRANGLE, WESTERN NEVADA

Geological Survey, Carson City, NV. Water Resources Div.

For primary bibliographic entry see Field 7C. W89-02538

DATA ON GROUNDWATER QUALITY FOR THE WINNEMUCCA ONE DEGREE X TWO DEGREE QUADRANGLE, CENTRAL NEVADA

Geological Survey, Carson City, NV. Water Resources Div. For primary bibliographic entry see Field 7C. W89-02539

DATA ON GROUNDWATER QUALITY FOR THE RENO ONE DEGREE X TWO DEGREE QUADRANGLE, WESTERN NEVADA, Geological Survey, Carson City, NV. Water Resources Div. For primary bibliographic entry see Field 7C. W89-02540

DATA ON GROUNDWATER QUALITY FOR THE WALKER LAKE ONE DEGREE X TWO DEGREE QUADRANGLE, WESTERN NEVADA AND EASTERN CALIFORNIA, Geological Survey, Helena, MT. Water Resources

Div

For primary bibliographic entry see Field 7C. W89-02541

DATA ON GROUNDWATER QUALITY FOR THE TONOPAH ONE DEGREE X TWO DEGREE QUADRANGLE, CENTRAL

Geological Survey, Carson City, NV. Water Resources Div. For primary bibliographic entry see Field 7C. W89-02542

DATA ON GROUNDWATER QUALITY FOR THE WESTERN NEVADA PART OF THE GOLDFIELD ONE DEGREE X TWO DEGREE OUADRANGLE.

Geological Survey, Carson City, NV. Water Resources Div For primary bibliographic entry see Field 7C.

W89-02543

DATA ON GROUNDWATER QUALITY FOR THE CALIENTE ONE DEGREE X TWO DEGREE QUADRANGLE, EASTERN NEVADA, Geological Survey, Carson City, NV. Water Resources Div. For primary bibliographic entry see Field 7C. W89-02544

DATA ON GROUNDWATER QUALITY FOR THE WESTERN NEVADA PART OF THE DEATH VALLEY ONE DEGREE X TWO DEGREE QUADRANGLE, Geological Survey, Carson City, NV. Water Re-

sources Div. For primary bibliographic entry see Field 7C. W89-02545

DATA ON GROUNDWATER QUALITY FOR THE SOUTHERN NEVADA PART OF THE KINGMAN ONE DEGREE X TWO DEGREE QUADRANGLE, Geological Survey, Carson City, NV. Water Re-

sources Div. For primary bibliographic entry see Field 7C. W89-02546

DEVELOPMENT OF ESTIMATION METHODS FOR TRIBUTARY LOADING RATES OF TOYIC CHEMICALS Notre Dame Univ., IN. Dept. of Civil Engineer-

ing.
V. J. Bierman, S. D. Preston, and S. E. Silliman. V. J. Bierman, S. D. Preston, and S. E. Siliman. Available from the National Technical Information Service, Springfield, VA 22161 as PB88-236062/AS. Price codes: A04 in paper copy; A01 in microfiche. Water Resources Research Center, Purdue Univ., West Lafayette, In. Technical Report No. 183, June 1988. 58p, 16 fig, 6 tab, 20 ref, append. Contract No. 14-08-0001-G1421. Project No. 11SGS G1421-09

Descriptors: *Waste-assimilative capacity, *Nutrients, *Toxic chemicals, *Suspended solids, *Statistical methods, *Estimation, Path of pollutants, Tributaries, Loading rates, Heavy metals, Polychlorinated biphenyls, Michigan, Saginaw River, Grand River, Water pollution sources.

USGS G1421-02.

itary loading estimation methods were evaluated by conducting retrospective studies with comprehensive sets of field data for flow rates, suspended solids, nutrients, heavy metals, and polychlorinated biphenyls (PCBs) from two different rivers. Three broad classes of leading estimation methods were investigated: simple averaging methods, ratio estimation methods, and regression methods. ods, ratio estimation methods, and regression methods. Estimators were evaluated using Monte Carlo sampling studies in which random subsamples of complete loading records were used to estimate annual loadings. These estimates were than compared to 'true' loadings determined by calculations using the entire record. No single estimation approach was found to be superior for all of the constituents and hydrologic conditions tested. For a given estimation method, differences in efficiency were dependent on the lessel of coursinces bea given estimation method, unterences in enticiency were dependent on the level of covariance between the constituent and the auxiliary variable used, the frequency of extreme concentration values, the functional form of the relationship bevaries, the functional form of the relaxioning between the constituent and the auxiliary variable, and the nature of the particular hydrograph. Relationships between the investigated constituents and suspended solids were generally weak and the use suspended solids as an auxiliary variable provided only marginal improvements in some cases, compared to using flow as an auxiliary variable. Hydrographs containing strong events caused load estimates to by highly biased. This bias could be estimates to by highly blased. This bias could be reduced by using event sampling instead of a fixed sampling frequency, provided that a flow-stratified estimation approach was used. (Cushman-Purdue Univ., WRRC) W89-02547

AGRICULTURAL IMPACT ON GROUNDWAT-

Purdue Univ., Lafayette, IN. Water Resources Research Center.

search Center.
R. F. Turco, and A. E. Konopka.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB88-236054/
AS. Price codes: A04 in paper copy; A01 in microfiche. Technical Report No. 185, June 1988, 56p,
I1 fig. 7 tab, 34 ref. Contract No. 14-08-0001G1421. Project No. USGS G1421-05.

Descriptors: *Indiana, *Nitrates, *Agricultural runoff, *Pesticides, *Biodegradation, *Groundwater quality, Herbicides, Nitrogen, Bacteria, Fate of pollutants, Path of pollutants, Aniline, Water pol-lution sources, Water pollution effects.

Concern over the possible occurrence of pesticides or nitrate in the groundwater is justified as nearly 100% of rural Indiana uses groundwater for drinking. A study to assess how groundwater has been affected by agriculture was initiated. Forty six wells in 4 counties were monitored for pesticides and the state of t and nitrate, and evaluated as to how placement and and nitrate, and evaluated as to how placement and depth affects water quality. Findings indicate that nitrate remains of primary concern. While 30% of the tested wells had elevated levels of N, only 8% would be considered a serious risk. It appears that the presence of animals or mishandling of materials in close proximity to the well has the most detrimental effect. With the exception of one site, contamination of well water by agricultural chemicals is not widespread. To better clarify the transformation of pesticides in soil and groundwater, studies were initiated to understand how a microorganism is able to utilize anijine, a herbicide intermediate. is able to utilize aniline, a herbicide intermediate, under single and mixed substrate conditions. Often under single and mixed substrate conditions. Often the pollutant material, such as aniline, is in low concentration as compared to other carbon sources. It appears that isolated bacteria is capable of simultaneous utilization of aniline and other organic substrates. This is important as it implies that pesticide transformation is possible in the presence of other personal of the presence of the ence of other more utilizable materials. (Cushman-Purdue Univ., WRRC) W89-02549

CONSIDERATION OF DIMENSIONAL DE-PENDENCE IN MODELLING THE STRUC-TURE OF FLOW ZONES WITHIN THE SUB-SURFACE.

Notre Dame Univ., IN. Dept. of Civil Engineer-

S. E. Silliman.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB88-235767/
AS. Price codes: A04 in paper copy; A01 in microfiche. Water Resources Research Center, Purdue
Univ., West Lafayette, IN. Technical Report No.
186, June 1988. 51p, 6 fig. 4 tab, 36 ref. Contract
No. 14-08-0001-G1421. Project No. USGS G142103.

Descriptors: *Hydraulic conductivity, *Simulation analysis, *Monte Carlo method, *Path of pollutants, Model studies, Water pollution sources, Heterogeneous hydraulic conductivity, Three-dimensional systems, Percolation, Subsurface flow.

The structural aspects of heterogeneous hydraulic conductivity fields were studied through the use of an analogy with percolation theory and Monte Carlo simulation on discretized representations of these fields. It has been shown previously that in three-dimensional systems, a path will exist within a conductivity field along which the conductivity is everywhere greater than the average conductivity of the medium. These efforts demonstrated, however, that in two dimensions such a path is however, that in two dimensions such a path is unlikely to occur. Focusing on this dimensional dependence it was demonstrated that the likelidependence it was demonstrated that the likelihood of observing such conductivity paths is dependent primarily on the thickness, perpendicular to the primary axis of consideration, of the numerical grid used for numerical modeling. Dimension along the primary flow axis is only of secondary consideration. These results imply that modeling the movement of chemical or biological contaminants in the presence of heterogeneity utilizing a two-dimensional model may result in underestimating either the probability of an early arrival of the chemical or the probability of movement of a

Sources Of Pollution-Group 5B

microorganism. Further, the information lost through reducing a model of two-dimensions cannot be regained through enhanced discretization within the two-dimensional plane. An improved model of the true three-dimensional behavior of a medium can be attained only through discretizing the numerical grid in the third dimension. The conclusions apply both to correlated and uncorrelated fields. (Cushman-Purdue Univ., WRRC) W89-02551

BIOGEOCHEMISTRY OF LEAD-210 AND PO-LONIUM-210 IN FRESH WATERS AND SEDI-MENTS.

usetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2K.
W89-02555

WATER QUALITY OF RUNOFF TO THE CLARKSVILLE MEMORIAL HOSPITAL DRAINAGE WELL AND OF MOBLEY SPRING, CLARKSVILLE, TENNESSEE, FEBRUARY-MARCH 1988, Geological Survey, Nashville, TN. Water Re-

sources Div.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 88-310, 1988. 26p, 7 fig, 3 tab, 8 ref.

Descriptors: *Water pollution sources, *Ground-water pollution, *Urban runoff, *Drainage wells, *Water quality, *Trace metals, *Tennessee, Clarks-ville, Sinks, Karst, Organic compounds.

A drainage well and a spring in Clarksville, Tennessee, have been instrumented to collect storm related data in order to define the types and conrelated data in order to define the types and con-centrations of water quality characteristics in stormwater runoff and in the receiving groundwater basin. Water quality samples of storm runoff at the drainage well at Clarksville Memorial Hospital and of nearby Mobley Spring were collected during four storms and during normal flow condi-tions during February and March 1988. Samples were analyzed for major inorganic water quality constituents, selected trace metals, and organics. Several samples from the drainage well and the spring had trace-metals concentrations that exceed-d maximum contaminant levels for State drinkingspring had trace-metals concentrations that exceed-ed maximum contaminant levels for State drinking-water standards. Organic compounds including phenols, polynuclear aromatic hydrocarbons, and other base-neutral extractable organic substance are present in samples from both the drainage well and spring. (USGS) W89-02556

QUALITY OF GROUNDWATER IN SHALLOW WELLS IN AGRICULTURAL AREAS OF HAY-WOOD, SHELBY, LAKE, AND OBION COUN-TIES, TENNESSEE, JANUARY-FEBRUARY

Geological Survey, Nashville, TN. Water Re-

D. B. Withington.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 88-309, 12p, 4 fig, 3 tab, 8 ref.

Descriptors: *Groundwater pollution, *Water pollution sources, *Tennessee, *Sampling, *Agricultural chemicals, *Water quality, Fertilizers, Pesti-

Three areas with sparse data on the impact of agricultural chemicals on groundwater quality in the state of Tennessee were chosen for sampling the state or Tennessee were chosen for sampling groundwater for nitrogen species and pesticides. These sites, located in Haywood, Shelby, and Lake Counties, are all areas of high intensity agriculture. Because of the importance of the surficial alluvial aquifer to the domestic supply in West Tennessee, shallow wells at each site were sampled. Two sampling events were scheduled, in the writer and in the spring to establish the difference hattern. in the spring, to establish the difference between background and effected contaminant levels. Preliminary results from the first sampling event indi-cate a range of nitrite plus nitrate as nitrogen

concentrations from less than 0.1 to 7.8 milligrams per liter. The results from triazine analyses show concentrations below the detection limit. (USGS) W89-02557

GEOHYDROLOGY AND SUSCEPTIBILITY OF MAJOR AQUIFERS TO SURFACE CONTAMI-NATION IN ALABAMA; AREA 9, Geological Survey, Tuscaloosa, AL. Water Re-

R. F. Kidd

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 87-4187, 1987. 33p, 7 fig, 1 plate, 2 tab, 39

Descriptors: *Aquifers, *Groundwater pollution, *Water pollution sources, *Alabama, Potentiometric surface, Geohydrology, Depressions, Barbour County, Bullock County, Macon County, Pike County, Russell County.

This report delineates and describes the geohydrology and susceptibility of the major aquifers to contamination in Area 9 - Barbour, Bullock, Macon, Pike, and Russell Counties. The major aquifers in the study area are the Tuscaloosa, Eutaw, and Providence-Ripley aquifers of Cretacous age; and the Nanafalia-Clayton aquifer of Tertiary age. The five counties constitute the primary recharge area for the aquifers which are the source of public supplies in the study area. The total withdrawals of groundwater for all uses in 1986 were estimated to be about 14 million gallons per day. Areas of water level declines in the Tuscaloosa aquifer have developed near Eufaula and per day. Areas of water level declines in the Tus-caloosa aquifer have developed near Eufaula and Union Springs. Water levels in the Eutaw aquifer have declined at Union Springs. All recharge areas for the major aquifers are susceptible to contamina-tion from the surface. Shallow wells in the outcrop area are most susceptible. (USGS)

GEOHYDROLOGY AND SUSCEPTIBILITY OF MAJOR AQUIFERS TO SURFACE CONTAMINATION IN ALABAMA; AREA 8, Geological Survey, Montgomery, AL. Water Re-

Geological Survey, Montgomery, AL. Water Resources Div. J. C. Scott, R. H. Cobb, and R. D. Castleberry. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 86-4360, 1987. 65p, 10 fig, 1 plate, 2 tab, 22 ref.

Descriptors: *Aquifers, *Carbonate rocks, *Groundwater movement, *Water pollution sources, *Groundwater pollution, *Alabama, Potentiometric level, Autauga County, Chilton County, Elmore County, Lowndes County, Montgomery County.

gomery County.

The report delineates and describes the geohydrology and susceptibility of the major aquifers to contamination in Area 8 - Autagua, Chilton, Elmore, Lowndes, and Montgomery Counties in south-central Alabama. The major aquifers in the study area are the Eutaw, Gordo, and Coker aquifers of Cretaceous age. The recharge areas for these aquifers are in Autauga, Chilton, Elmore, and Montgomery Counties. These aquifers are sources of public water supply in each of the five counties. All recharge areas for the major aquifers are susceptible to contamination from the surface. However, large parts of the recharge areas are in rural terrains that are used for timberlands, farms, and pastures, and are several miles from pumping centers, so these areas are not highly susceptible to contamination. (USGS) W89-02564 W89-02564

WATER QUALITY DATA (JULY 1986 THROUGH SEPTEMBER 1987) AND STATIS-TICAL SUMMARIES (MARCH 1985 THROUGH SEPTEMBER 1987) FOR THE CLARK FORK AND SELECTED TRIBUTARIES FROM DEER LODGE TO MISSOULA, MON-

Geological Survey, Helena, MT. Water Resources J. H. Lambing.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 88-308, 1988. 55p, 27 fig, 7 tab, 10 ref.

Descriptors: *Trace elements, *Suspended sediment, *Water quality data, *Montana, *Clark Fork River, Data collections.

Water quality sampling was conducted at seven sites on the Clark Fork and selected tributaries from Deer Lodge to Missoula, Montana, from July 1986 through September 1987. This report presents tabulations and statistical summaries of the water quality data. The data presented in this report supplement previous data collected from March 1985 through June 1986 for six of the seven sites. Included in this report are tabulations of instantaneous values of streamflow, onsite water quality, hardness, and concentrations of trace elements and suspended sediment for neriodic samples. Also inhardness, and concentrations of trace elements and suspended sediment for periodic samples. Also included are tables and hydrographs of daily mean values for streamflow, suspended-sediment concentration, and suspended-sediment discharge at three mainstream stations and one tributary. Statistical summaries are presented for periodic water quality data collected from March 1986 through September 1987. Selected data are illustrated by graphs showing median concentrations to suspended-sediment concentrations, and median concentrations of trace elements in suspended sediment. (USGS) W89-02566

GEOHYDROLOGY AND SUSCEPTIBILITY OF COLDWATER SPRING AND JACKSONVILLE FAULT AREAS TO SUFFACE CONTAMINA-TION IN CALHOUN COUNTY, ALABAMA, Geological Survey, Montgomery, AL. Water Resources Div.

J. C. Scott, W. F. Harris, and R. H. Cobb Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 87-4031, 1987. 29p, 3 fig, 1 plate, 1 tab, 17

Descriptors: *Aquifers, *Carbonate rocks, *Groundwater movement, *Water pollution sources, *Groundwater pollution, *Alabama, Calhoun County, Potentiometric level.

Coldwater Spring in eastern Calhoun County, Alabama, is one of the largest springs in Alabama. The spring, which has an average discharge of about 31 million gallons per day, supplies water for about 70,000 people in the Anniston, Alabama area. A potentiometric map of the study area indicates that he recharge area for the aquifer system that supplies the spring is only about 23 square miles. However, base-flow data for streams in the area indicate that this recharge area is not sufficient to account for an average discharge of 31 million gallons per day from Coldwater Spring. Complex folding and faulting of the carbonate and quart zitic rocks that comprise the aquifer system may have produced fractures and joints that increase recharge to the spring. Some recharge to the spring may be derived from outside the recharge area delineated from the potentiometric map or spring may be derived from outside the recharge area delineated from the potentiometric map or from the surface. This part of the recharge area contamination from the surface. This part of the recharge area consists of flat to gently rolling terrain underlain by cavernous limestone and fractured quartie. (USGS) W89-02576

GEOHYDROLOGY AND SUSCEPTIBILITY OF MAJOR AQUIFERS TO SURFACE CONTAMI-NATION IN ALABAMA, AREA 7,

Geological Survey, Tuscaloosa, AL. Water Resources Div. W. S. Mooty.

w. S. Mooty. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 87-4109, 1987. 28p, 4 fig, 1 plate, 2 tab, 27 ref.

Descriptors: "Aquifers, "Groundwater pollution, *Water pollution sources, "Groundwater move-ment, "Potentiometric surface, "Alabama, Geohy-drology, Sinkholes, Bibb County, Dallas County, Hale County, Perry County, Wilcox County.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B-Sources Of Pollution

The geohydrology and susceptibility of the seven major aquifers to surface contamination in Area 7 -Bibb, Dallas, Hale, Perry, and Wilcox Counties, are described. Aquifers in the northern part of the are described. Aquifers in the northern part of the study area are in Paleozoic limestones and dolomite formations. Deposits in the central part of the study area are predominately of Cretaceous age and contain the Coker, Gordo, and Eutaw aquifers. Although the southern part of the study area has many deposits of Tertiary age, the Ripley Formation of Cretaceous age is the major aquifers. Contamination of any of the major aquifers is improbable because the majority of the recharge area for the primary aquifers is woodland, pasture, or farmland. Downdip from their outcrops, the major aquifers in the study area are protected from land surface contamination by relatively impermeable layers of clay and chalk. The aquifers that are highly susceptible to contamination are the ones in able layers of clay and chair. The aquiters that are highly susceptible to contamination are the ones in the limestone and dolomite formations in northern Bibb County. Sinkholes exist in the recharge area of these formations and could provide a direct link for contaminates from the land surface to the water for contaminates from the land surface to the water table. An area northeast of the Selma well field is also highly susceptible to contamination. The Eutaw Formation in this area is overlain by alluvial deposits that could increase recharge to the aquifer by slowing the runoff rate of surface water. (USGS) W89-02577

GEOHYDROLOGY AND SUSCEPTIBILITY OF MAJOR AQUIFERS TO SURFACE CONTAMINATION IN ALABAMA, AREA 1, Geological Survey, Tuscaloosa, AL. Water Re-

Geological Survey, Tuscaloosa, A.L. Water Resources Div. C. R. Bossong, and W. F. Harris. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 87-4068, 1987. 34p, 5 fig, 1 plate, 3 tab, 39 ref.

Descriptors: *Aquifers, *Carbonate rocks, *Groundwater movement, *Potentiometric level, *Groundwater pollution, sources, *Alabama, Barbour County, Macon County, Pike County, Russell

This report delineates and describes the geohydro-logy and susceptibility of the major aquifers to contamination in Area 1 - Colbert, Franklin, Lau-derdale, Lawrence, Limeston, Madison, and Morgan Counties. Most of the area is underlain by Morgan Counties. Most of the area is underlain by a Mississippian carbonate sequence that includes two major aquifers, the Tuscumbia-Fort Payne aquifer and the Bangor aquifer. A third major aquifer the Tuscalcosa aquifer of Cretaceous age, occurs in the southwest part of the area. The Mississippi carbonate aquifers are the Tuscumbia-Fort Payne aquifer which includes most Tuscumbia Limestone and the Fort Payne Chert, and a small area of the Monteagle Limestone, and the Bangor aquifer which includes the Bangor Limestone and Hartselle Sandstone. Both of these aquifers possess highly-variable secondary porosity and permeability related to fractures that have been enlarged, sometimes to cavernous proportions, due to solution processes. The Tuscalcosa aquifer consists of the Tuscalcosa Group, an unconsolidated clastic deposit that has relatively uniform primary porosity and permeability. Significonsolidated clastic deposit that has relatively uniform primary porosity and permeability. Significant quantities of groundwater are available from each of the aquifers. Water levels at nearly 2,000 wells indicate that, for each aquifer, general groundwater movement is from topographically high to low areas. Each of the aquifers is reharged throughout its outcrop in the study area and is susceptible to contamination within the outcrop. Generalized topographic settings such as closed-contour depressions are identified as areas that are highly susceptible to contamination. Specific features such as sinkholes also are identified as cific features such as sinkholes also are identified as extremely susceptible to contamination. (USGS) W89-02578

U.S. GEOLOGICAL SURVEY URBAN-STORM-WATER DATA BASE OF CONSTITUENT STORM LOADS; CHARACTERISTICS OF RAINFALL, RUNOFF, AND ANTECEDENT CONDITIONS; AND BASIN CHARACTERISTERS

Geological Survey, Denver, CO. Water Resources

For primary bibliographic entry see Field 7C. W89-02581

GROUNDWATER RESOURCES OF LIME-STONE COUNTY, TEXAS, Geological Survey, Austin, TX. Water Resources

For primary bibliographic entry see Field 2F. W89-02583

CONTRIBUTION OF TOXIC CHEMICALS TO GROUNDWATER FOR DOMESTIC ON-SITE SEWAGE DISPOSAL SYSTEMS, Connecticut Univ., Storts. Inst. of Water Re-

J. J. Kolega, D. W. Hill, and R. Laak

J. J. Kolega, D. W. Hill, and K. Lääk. Available from the National Technical Information Services, Springfield, VA 22161 as PB88-225784/ AS. Price codes: A03 in paper copy; A01 in microfiche. Report No. G-1007-04, October 1986. 40p, 7 tab, 8 fig. 15 ref. Contract No. 14-08-0001-G-1007. Project No. USGS G1007-04.

Descriptors: *Toxic chemical discharges, *Groundwater quality, *Connecticut, *Sewage dis-posal, *Volatile organics, Household wastewater discharges, Leachate, Soil adsorption, Toluene, Benzene, Gas chromatography, Path of pollutants, Fath of pollutants.

A multi-disciplinary (agricultural and civil engi-neering, microchemistry and soil science) study was conducted, in cooperation with a water utility was conducted, in cooperation with a water utility and a state regulatory agency, to evaluate with a water utility and a state regulatory agency, to evaluate the movement of selected household toxic chemical discharges from the conventional on-site sewage disposal system into the surrounding groundwater. Connecticut sites selected for the groundwater. Connecticut sites selected for the study were a condominium; a community on-site sewage disposal system serving 43 single family dwellings; and a single family residence served by the RUCK denitrification system. In addition, a soil batch extraction method was used to study the soil adsorption of 14C labeled benzene on eight different Connecticut soils. Gas chromatography was used to identify volatile organic compounds in the aqueous samples collected using the purge and trap method following U.S. EPA 601 methodology. Six hox-types soil columns were used to study trap method following U.S. EPA 601 methodology. Six box-type soil columns were used to study the fate of toluene in sewage effluent passing through a 0.9 meter (3 foot) depth of concrete sand. The toluene was mixed with 'black-water' sewage effluent coming from the RUCK denitrifi-Swage ennuent coming from the RUCK denitrification system. High performance liquid chromatography was used for toluene detection in the liquid samples. (Kolega-CT Univ., 1WWR) W89-02584

WATER SYSTEM RESPONSES TO TOXIC CONTAMINATION OF GROUNDWATER SUP-PLIES.

Wisconsin Univ.-Milwaukee. Dept. of Urban Planning.

For primary bibliographic entry see Field 5F. W89-02586

GEOHYDROLOGY AND SUSCEPTIBILITY OF MAJOR AQUIFERS TO SURFACE CONTAMINATION IN ALABAMA, AREA 6, Geological Survey, Tuscaloosa, AL. Water Resources Div.

Solices Div.

S. S. DeJarnette, and J. E. Crownover.
Available from OFSS, USGS, Box 25425, Denver
Co. 80225. USGS Water Resources Investigations
Report 87-4113, 1987. 27p, 6 fig. 1 plate, 2 tab, 22

Descriptors: *Aquifers, *Groundwater movement, *Potentiometric level, *Groundwater pollution, *Water pollution sources, *Alabama, Water pollution, Greene County, Marengo County, Pickens County, Sumter County, Tuscaloosa County.

This report delineates and describes the geohyrology and susceptibility of the major aquifers to contamination in Area 6, Greene, Marengo, Pick-

ens, Sumter, and Tuscaloosa Counties in west-central Alabama. The major aquifers in the study area are the Nanafalia, Eutaw, Gordo, and Coker aquifers of Tertiary and Cretaceous age. The recharge areas for one or more of these aquifers are in each of the five counties. East aquifer is a source of public water supply in one or more of the five counties. All recharge areas for the major aquifers are susceptible to contamination from the surface. However, large parts of the recharge areas are in rural settings that are used for timberlands, farms, and pastures, and are several miles from pumping centers; therefore, these areas are not highly susceptible to contamination. (USGS) W89-02590

CALIBRATION OF A DISSOLVED-SOLIDS MODEL FOR THE YAMPA RIVER BASIN BE-TWEEN STEAMBOAT SPRINGS AND MAY-BELL, NORTHWESTERN COLORADO,

Geological Survey, Lakewood, CO. Water Resources Div.

sources Liv.
R. S. Parker, and D. W. Litke.
Available from OFSS, USGS, Box 25425, Denver,
CO 80225. USGS Water Resources Investigations
Report 86-4190, 1987. 36p, 16 fig, 11 tab, 9 ref.

Descriptors: *Model studies, *Water quality, *Mine drainage, *Colorado, *Yampa River, *Water pollution sources, Stream discharge, Streamflow, Coal mining.

The cumulative effects of changes in dissolved solids from a number of coal mines are needed to evaluate effects on downstream water use. A model for determining cumulative effects of streamflow, dissolved-solids concentration, and dissolved-solids load was calibrated for the Yampa dissolved-solids load was calibrated for the Yampa River and its tributaries in northwestern Colorado. The model uses accounting principles. It establishes nodes on the stream system and sums water quantity and quality from node to node in the downstream direction. The model operates on a monthly time step for the study period that includes water years 1976 through 1981. Output is monthly mean streamflow, dissolved-solids concentration, and dissolved-solids load. Streamflow and dissolved-solids day from streamflowareains. and dissolved-solids data from streamflow-gaging stations and other data-collection sites were used stations and other data-collection sites were used to define input data sets to initiate and to calibrate the model. The model was calibrated at four nodes and generally was within 10 percent of the observed values. The calibrated model can compute changes in dissolved-solids concentration or load resulting from the cumulative effects of new coal mines or the expansion of old coal mines in the Yampa River basin. (USGS)

SURFACE WATER QUALITY CHARACTERISTICS IN THE UPPER NORTH FORK GUNNISON RIVER BASIN, COLORADO, Geological Survey, Lakewood, CO. Water Resources Div.

J. M. Norris Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 86-4152, 1987. 42p, 12 fig, 20 tab, 5 ref.

Descriptors: *Water quality, *Gunnison River, *Colorado, *Hydrologic data collection, *Surface water, Dissolved constituents, Trace elements.

Analyses of water quality data collected during 1982 and 1983 in the upper North Fork Gunnison River basin indicate that dissolved-solids concentrations are relatively small, with a mean value near 97 milligrams per liter. Most major dissolved constituents also had small measured concentrations throughout the study area. Trace-element concentrations generally were small; however, total-iron concentration generally was large in the area with a mean concentration of about 8,250 micrograms per liter. The cause of this larger iron concentration probably is related to the local geology. Paonia Reservoir, located on Muddy Creek, greatly reduced suspended-sediment and trace-elegreatly reduced suspended-sediment and trace-element concentrations. The reservoir had only a slight effect on major dissolved-constituent concentrations. Analyses of alkalinity, sulfate, and dis-

Sources Of Pollution—Group 5B

solved-solids concentrations indicated that little, if any, changes in water quality occur as a result of coal mining; however, more data are needed to coal mining; nowever, more data are needed to make more definite conclusions. Sulfate concentrations increased slightly downstream through the mined area; however, with the small concentrations measured and limited quantity of data, the source of the increased sulfate could not be determined. mined. (USGS)

ANALYTICALLY-DERIVED SENSITIVITIES IN ONE-DIMENSIONAL MODELS OF SOLUTE TRANSPORT IN POROUS MEDIA, Geological Survey, Reston, VA. Water Resources

Div. D. S. Knopman Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-605, 1987. 97p, 1 tab, 4 ref, append.

Descriptors: *Model studies, *Solute transport, *Path of pollutants, *Groundwater movement, *Computer programs, Sensitiivity analysis, Porous media, FORTRAN, Advection-dispersion equation, Parameter estimation.

Analytically-derived sensitivities are presented for parameters in one-dimensional models of solute transport in porous media. Sensitivities were de-rived by direct differentiation of closed form solurived by direct differentiation of closed form solu-tions for each of the odel, and by a time integral method for two of the models. Models are based on the advection-dispersion equation and include adsorption and first-order chemical decay. Bound-ary conditions considered are: a constant step input of solute, constant flux input of solute, and expon-entially decaying input of solute at the upstream boundary. A zero flux is assumed at the down-stream boundary. Initial conditions include a con-stant and spatially varying distribution of solute. One model simulates the mixing of solute in an observation well from individual layers in a multi-layer aquifer system. Computer programs produce layer aquifer system. Computer programs produce output files compatible with graphics software in which sensitivities are plotted as a function of either time or space. (USGS)

W89-02595

HYDROLOGY OF THE WHITE TAIL BUTTE AREA, NORTHERN CAMPBELL COUNTY, WYOMING, Geological Survey, Cheyenne, WY. Water Re-

Geological sources Div. For primary bibliographic entry see Field 4C. W89-02596

HYDROLOGY OF AREA 8, EASTERN COAL PROVINCE, WEST VIRGINIA AND OHIO, Geological Survey, Charleston, WV. Water Resources Div For primary bibliographic entry see Field 4C. W89-02598

RELATIONS OF SPECIFIC CONDUCTANCE TO STREAMFLOW AND SELECTED WATER QUALITY CHARACTERISTICS OF THE AR-KANSAS RIVER BASIN, COLORADO, Geological Survey, Denver, CO. Water Resources Div.

For primary bibliographic entry see Field 2K. W89-02599

WATER QUALITY DATA FOR ORWELL RESERVOIR AND THE OTTER TAIL RIVER NEAR FERGUS FALLS, MINNESOTA,
Geological Survey, St. Paul, MN. Water Re-

sources Div.

sources Div.
M. R. Have, and L. H. Tornes.
Available from OFSS, USGS, Box 25425, Denver,
CO 80225. USGS Open-File Report 87-537, 1987.
49p, 1 fig, 10 tab, 11 ref.

Descriptors: *Water quality, *Hydrologic data, *Data collections, *Minnesota, Reservoirs, Fergus Falls, Orwell Reservoir, Otter Tail River.

Water quality data were collected in Minnesota at five sites on Orwell Reservoir and two sites on the

Otter Tail River, at the inflow and outflow points of the reservoir. The data, collected from April 1985 to July 1986, consist mainly of streamflow 1985 to July 1986, consist mainly of streamflow and nutrient concentrations at the river sites and nutrient concentrations, alkalinity, Secchi-disk transparency, phytoplankton counts, chlorophyll concentrations and profiles of specific conductance, temperature, pH, and dissolved oxygen at the reservoir sites. Additional data collected at the outflow site include alkalinity and concentrations of major ions and organic carbon. (USGS) W89-02605

METAL SPECIATION: THEORY, ANALYSIS

AND APPLICATION.
Lewis Publishers, Chelsea, Michigan. 1988. 357p.
Edited by James R. Kramer and Herbert E. Allen.

Descriptors: *Trace metals, *Path of pollutants, *Water pollution, *Water quality, *Chemical analysis, *Metals, *Chemical reactions, Metal complexes, Data acquisition, Water pollution effects.

There have been great advances in the past few years in the understanding of trace metals in envi-ronmental systems. A workshop on metal specia-tion which was held at Jekyll Island, Georgia, May 20-22, 1987, covered three main themes: theory, measurements, and fate and effects. Overviews of measurements, and fate and effects. Overviews of the topic and examples of the significance of metal speciation to the solution of environmental problems are provided. New analytical approaches have been used to determine the nature of metal binding by dissolved and particulate matter; the applicability of older methods has been re-evaluated. Uses of size separation methods and extraction techniques are presented. The application of a second of the control of the con techniques are presented. The application of a wide variety of instrumental methods, including wide variety of instrumental methods, including voltametric and chromatographic techniques are discussed. The complexity of reactions of metals has been realized, and new approaches have promoted the interpretation of reactions in multiligand systems. Chapters address the significance of speciation to bioavailability to humans, plants and aquatic organisms. Applications showing the importance of speciation in marine, lake, groundwater and industrial waste treatment systems have water and industrial waste treatment systems have been included. A series of chapters are concerned with the solid-solution interface and consider the with the solid-solution interface and consider the nature of the surfaces, the binding of metals to oxides and sediments, and the influence of mineral surfaces on the fate of organic pollutants. (See W89-02641 thru W89-02653) (VerNooy-PTT) W89-02640

THERMODYNAMIC CALCULATIONS WITH SPECIAL REFERENCE TO THE AQUEOUS ALUMINUM SYSTEM, Umea Univ. (Sweden). Dept. of Inorganic Chemis-

try.
For primary bibliographic entry see Field 2K.
W89-02641

COORDINATION CHEMISTRY AT THE SOLID/SOLUTION INTERFACE, Stanford Univ., CA. Dept. of Civil Engineering.

IN: Metal Speciation: Theory, Analysis and Application. Lewis Publishers, Chelsea, Michigan. 1988. p 41-68, 4 fig, 2 tab, 60 ref.

Descriptors: *Weathering, *Sediment-water interfaces, *Metal complexes, *Chemical reactions, *Trace metals, Path of pollutants, Metals, Chemical composition.

The speciation of trace elements in natural aquatic systems includes the formation of surface complexes at the solid/solution interface. The importance of chemical speciation at solid/solution interfaces in natural aquatic systems becomes apparent when in natural aquatic systems occurred apparent when the type and nature of particulates in natural waters (suspended and deposited) is considered. The particulates in natural waters consist predomi-nantly of detrital organic colloidal matter, living range particulates in natural waters consist predomi-nantly of detrital organic colloidal matter, living cells (bacteria and algae), and inorganic solids such as metal oxides and hydroxides, carbonates, clays, and detrital network or layered silicates. The appli-cation of surface complexation models to a wide variety of engineering and natural aquatic systems

is well accepted. Formation of surface complexes, and surface complexes in dissolution and electron exchange reactions are reviewed. Modeling efforts have found effective use in gaining insights into the have found effective use in gaining insights into the role surface complexes play in transport and transformation of trace elements. The chemical weathering processes, extant in aqueous systems and in the electron exchange reactions, result in both oxidative and reductive dissolution of redox sensitive minerals. The next decade should see greatly expanded knowledge and application of these surface complexation concepts to an ever widening range of both engineered and natural aqueous systems. (See also W89-02640) (VerNooy-PTT) W89-02642

INTRODUCTION TO INTERACTIONS OF OR-GANIC COMPOUNDS WITH MINERAL SUR-

Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering

IN: Metal Speciation: Theory, Analysis and Application. Lewis Publishers, Chelsea, Michigan. 1988. p 69-80, 2 fig, 34 ref.

Descriptors: *Organic compounds, *Minerals, *Chemical reactions, *Path of pollutants, *Metals, Kinetics, Chemical properties, Aquatic environ-

Ways in which (1) organic compounds influence ways in when (1) organic compounds intuence the solubility and reactivity of mineral surfaces and (2) mineral surfaces influence chemical transforma-tions of organic compounds are outlined. Specific and non-specific interactions of organic com-pounds with mineral surfaces are involved in a wide variety of important transformation reactions in aquatic environments. A unified approach to surface chemical reaction leads to valuable insights into the effects of chemical structure, medium composition, and speciation on reaction kinetics and mechanisms. Although a wide variety of interactions between organic compounds and mineral surfaces have been postulated and observed, de-tailed understanding has been limited by lack of knowledge concerning surface speciation and mechanisms of surface chemical reactions. New mechanisms of surface chemical reactions. New experimental approaches to studying reactions at mineral surfaces are being explored in a number of laboratories, which will improve our conceptual and practical understanding of these processes. (See also W89-02640) (VerNooy-PTT) W89-02643

REACTIONS AND TRANSPORT OF TRACE METALS IN GROUNDWATER, Clarkson Univ., Potsdam, NY. Dept. of Civil and Environmental Engineering.

T. L. Theis.

IN: Metal Speciation: Theory, Analysis and Application. Lewis Publishers, Chelsea, Michigan. 1988. p 81-98, 14 fig. 3 tab, 15 ref. EPA Grant CR807859 and Dept. of Energy Grant DE-AC02-79EV10253.

Descriptors: *Chemical reactions, *Path of pollutants, *Trace metals, *Metals, *Groundwater pollution, *Kinetics, Groundwater movement, Metal complexes. Chemical analysis.

Trace metals in the aquatic environment are capable of undergoing many kinds of reactions including oxidation-reduction, solubility, and surface and solution phase complexations. The chemical interactions of a single metal or species must be viewed as a function of all other species reactions. Examples of multicomponent transport with local equibirium and multicomponent transport-kinetic effects illustrate the dynamic nature of the trace metal transport explains and the complication. fects illustrate the dynamic nature of the trace metal transport problem and the complicating factor of partitioning kinetics. Also discussed are batch systems. Batch suspensions of soils or miner-als are poor systems for making measurements for groundwaters. Their problems, however, are large-ly overcome with small, or mini-, column tech-niques. The requirement of chemical kinetics versus local equilibrium for describing the trans-port of trace metals in the subsurface is a matter of both practical experimental as well as theoretical concern. Those problems for which a kinetic ap-

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B-Sources Of Pollution

proach is more likely to be necessary are those for which pore diffusion and/or secondary surface reactions exist, plus those for which removal of contaminants is occurring, such as during the flushing of an aquifer. (See also W89-02640) (Ver-Nooy-PTT) W89-02644

COMBINING FIELD MEASUREMENTS FOR SPECIATION IN NON PERTURBABLE WATER SAMPLES: APPLICATION TO THE IRON AND SULFIDE CYCLES IN A EUTRO-PHIC LAKE, Geneva Univ. (Swelfied). Dept. of Inorganic, Application).

Analytical and Applied Chemistry.

J. Buffle, R. R. De Vitre, D. Perret, and G. G.

Leppard.

IN: Metal Speciation: Theory, Analysis and Application. Lewis Publishers, Chelsea, Michigan. 1988. p 99-124, 9 fig, 25 ref.

Descriptors: *Field tests, *Trace metals, *Chemical analysis, *Sulfides, *Iron, *Manganese, *Eutrophic lakes, Water quality, Data acquisition, Chemical composition, Path of pollutants, Limnology.

An approach to speciation measurement is applica-ble to very reactive sulfide, iron and manganese formed in the water column of stratified eutrophic lakes. The lake studied is Lake Bret (Vaud, Switsaces. The lake studied is Lake Diet (vaul, Switzerland) which receives a large amount of phosphate, giving rise to high primary productivity in spring and summer. By combining the results of various analytical methods and knowing the nature and quantitative role of the major physico-chemical factors which influence each of them, it should be possible to find the physico-chemical characterbe possible to find the physico-chemical characteristics of the most important species and the distribution of the element between these species. This approach was applied to Lake Bret for characterizing and following the seasonal trends of the differing and following the seasonal trends of the different types of natural organic matter, Mn species, iron species, and sulfide species. Atomic absorption spectrometry, differential pulse polarography, and the colorimetric o-phenanthroline method were used. By applying the multimethod approach to follow the spatial and seasonal trends in lake composition, it was possible to get a more precise description of the detailed chemical stratification of the anoxic zone and of the oxic/anoxic interface redox components. In general the multimethe of the anoxic zone and of the Oxic/anoxic interface redox components. In general the multimethod approach should open up a wide range of applica-tions, since it can make use of the very large pool of instrumental techniques developed in the last two decades. (See also W89-02644) (VerNooy-PTT) W89-02645

CHROMATOGRAPHIC APPROACHES TO TRACE ELEMENT SPECIATION, Macdonald Coll., Ste. Anne de Bellevue (Quebec). Dept. of Food Science and Agricultural Chemis-

For primary bibliographic entry see Field 5A. W89-02648

PARTITIONING OF TRACE METALS IN SEDI-MENTS, Quebec Univ., Sainte-Foy

QUEDEC UTIV., JOHNS-P. A. Tessier, and P. G. C. Campbell.
IN: Metal Speciation: Theory, Analysis and Application. Lewis Publishers, Chelsea, Michigan. 1988.
p 183-199, 1 tab, 53 ref.

Descriptors: *Trace metals, *Sediments, *Chemical analysis, *Chemical composition, Thermodynamics, Adsorption, Data acquisition, Path of pollutants, Fate of pollutants.

Metals entering the aquatic environment, whether from atmospheric or terrestrial sources, will parti-tion between various compartments. Sediments constitute a concentrated reservoir of trace metals; the concentrations in this compartment are orders of magnitude higher than those found in the adja-cent overlying or interstitial waters. The merits and limitations of the two indirect methods presently available for estimating trace metal partitioning in aquatic sediments are discussed: thermodyic calculations and partial extraction

niques. Emphasis is given to surficial oxic sediments, i.e. those most relevant to benthic orga-nisms. A review of models based on the competinisms. A review of models based on the competi-tive adsorption of trace metals by various compo-nents of the oxic sediments is given. As an alterna-tive to metal partitioning models, methods have been suggested for separating the trace metals present in the sediments into various operational fractions by using chemical reagents of various strengths. Some of the extraction techniques and their limitations are discussed. Despite widespread recognition of the need to determine the forms of trace metals in sediments in order to understand the biological and geochemical processes involving trace metals in sediments in order to understand the biological and geochemical processes involving these metals, there is no entirely satisfactory method for determining metal partitioning. (See also W89-02649) (VerNooy-PTT) W89-02649

METAL SPECIATION AND INTERACTIONS AMONG ELEMENTS AFFECT TRACE ELE-MENT TRANSFER IN AGRICULTURAL AND ENVIRONMENTAL FOOD-CHAINS,

Agricultural Research Service, Beltsville, MD. Soil-Microbial System Lab.

Soli-waterous 298cm 236. IN: Metal Speciation: Theory, Analysis and Appli-cation. Lewis Publishers, Chelsea, Michigan. 1988. p 219-260, 5 tab, 4 fig, 134 ref.

Descriptors: *Metals, *Trace metals, *Trace elements, *Path of pollutants, *Bioaccumulation, *Soil-water-plant relationships, *Food chains, Sludge utilization, Environmental effects, Iron, Cadmium, Copper, Zinc.

Transfer of trace elements in agricultural and environmental food-chains is important because crops absorb trace elements due to stack emissions, or to disposal of sewage sludge and other wastes on cropland. Risk to the environment and to the foodcropland. Risk to the environment and to the food-chain is a principle limit to application of metal rich sludges on land. A few examples of character-ization of chemical species of trace elements in agriculture, in nutrition, and environmental risk, are summarized. Food-chain pathways are dis-cussed, as well as plant uptake of trace metals from contaminated soils. The latter is normally the first step of trace elements in their entry to agricultural food chains. The transport of iron, cadmium, copper and zinc are discussed. (See also W89-02640) (VerNooy-PTT) W89-02650

TRACE METAL SPECIATION IN SEDIMENTS AND SOILS: AN OVERVIEW FROM A WATER INDUSTRY PERSPECTIVE, Water Research Centre, Medmenham (England). A. M. Gunn, D. A. Winnard, and D. T. E. Hunt. IN: Metal Speciation: Theory, Analysis and Application. Lewis Publishers, Chelsea, Michigan. 1988. p 261-294, 16 fig, 5 tab, 40 ref.

Descriptors: *Trace metals, *Soil-water-plant relationships, *Metal complexes, *Path of pollutants, *Sediments, Chemical analysis, *Bioaccumulation, Toxicity.

Trace metals are of concern as contaminants of Trace metals are of concern as contaminants of terrestrial and aquatic systems because of their persistence and toxicity at low concentrations. There is considerable evidence that the bioavailability and toxicity of such metals are markedly influenced by the physico-chemical form in which they are present – in waters, in sediments and in soils. There is growing evidence that the uptake of metals by plants is often best predicted by the free metal ion activity in the soil water. The effects of acid and/or reducing conditions in the gut of benthic detritivores may, however, make this concept overly simple, in which case some other benthic detritivores may, however, make this concept overly simple, in which case some other means of assessing the bioavailability of sediment-bound metal would be required. In either event, concerted chemical and biological studies are essential to judge the validity of any procedure for estimating metal bioavailability. An approach in which individually-doped chemical phases are mixed with natural sediments and employed in concerted chemical and biological studies, has considerable promise for the cost-effective evaluation of proposed chemical measures of bioavailable metal. Although the doped substrates are 'unnatu-ral', the stability constants of the partition equilibri-um model (for example) will themselves have been obtained by measurements on 'pure' iron and man-ganese oxides, and on humic matter extracted from soil or water. The use of sediments amended with soil or water. The use of seculments amended with doped phases is not a substitute for assessment, using real samples, of any technique for assessing metal bioavailability. Rather it is an adjunct to such work, by which one can make a preliminary assessment of the technique. (See also W89-02640) (VerNooy-PTT) W89-02651

TRANSPORT, BIOACCUMULATION, AND TOXICITY OF METALS AND METALLOIDS IN MICROORGANISMS UNDER ENVIRONMENTAL STRESS,

Gray Freshwater Biological Inst., Navarre, MN. J. M. Wood.

J. N. Wodd.
IN: Metal Speciation: Theory, Analysis and Application. Lewis Publishers, Chelsea, Michigan. 1988.
p 295-314, 5 fig, 3 tab, 16 ref.

Descriptors: *Acid rain effects, *Path of pollutants, *Bioaccumulation, *Toxicity, *Metals *Heavy metals, *Microorganisms, *Water pollu-tion effects, Estuaries, Lakes, Acid rain, Chemical reactions, Food chains, Fish.

Inorganic chemical species, and their reactivities in water, depend on pH and E(0). Therefore it is critically important to understand the potential impact of changing pH and E(0) on the toxicity of inorganic ions towards biota in both freshwater and marine ecosystems. Where it is possible, the pathways for a number of toxic elements in two ecological extremes are discussed, a system under constantly changing conditions, (i.e., estuaries), and a system under artificial stress (i.e., acid susceptible freshwater lakes). These two subjects are treated with the appropriate concerns for ecosystem stability. Also dealt with is the potential effects of heavy metal and metalloid pollution on the accumulation of toxic metal ions in drinking water, food chains leading to fish, and in plants. Factors influencing the bioavailability for the essential redox-active metals and metalloids Fe, Mn, Zn, Cu, Cr, Co, Ni, As, and Se as these elements move from freshwater to saltwater are discussed, as well Cu, Cr, Co, Ni, As, and Se as these elements move from freshwater to saltwater are discussed, as well as the bioavailability of Hg. In acid sensitive lakes, the transport and bioaccumulation of Al and Hg was examined. Much can be learned by developing a detailed understanding, at the biochemical level, of how living organisms protect themselves against poisoning by soluble heavy metal and metalloid species in water. Some recent research shows how fast exchange ions Ca(++), Mg(++), Na(+) and K(+) can play a protective role in the prevention of toxic element transport into microorganisms. (See also W89-02640) (VerNooy-PTT) W89-02652

NATIONAL SURVEY OF PESTICIDES IN DRINKING WATER WELLS,

Environmental Protection Agency, Washington, DC. Office of Drinking Water.

IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p 7-11, 1 ref.

Descriptors: *Groundwater pollution, *Drinking water, *Wells, *Pesticides, Survey, Environmental Protection, Groundwater.

The reasons for the U.S. Environmental Protection Agency's conducting the nationwide survey of pesticides in drinking water wells that is planned for over the next two years are explained. The goals of the survey are to obtain sufficient information to characterize pesticide contamination in the drinking water wells of the nation and to determine how westigide concentrations in drinking. drinking water wells of the nation and to deter-mine how pesticide concentrations in drinking water wells correlate with patterns of pesticide usage and with ground water vulnerability. The survey's design and how it will be conducted are described. The statistical design, the analytical methods, the health advisories, and the question-naire are discussed. The status of the survey plan-

Sources Of Pollution-Group 5B

ng effort is presented. (See also W89-02654) (Davis-PTT) W89-02656

GROUND WATER CONSERVATION TECHNIQUES: POTENTIAL IMPACTS ON WATER USAGE AND QUALITY, Oklahoma State Univ., Stillwater. Dept. of Agri-

Oklanoma State Univ., Stillwater. Dept. of cultural Economics. For primary bibliographic entry see Field 3F. W89-02658

GROUND WATER CONTAMINATION FROM SALTWATER INTRUSION AND LIMITATIONS ON AGRICULTURAL ACTIVITIES, North Texas State Univ., Denton. Inst. of Applied

Sciences.
S. F. Atkinson.
IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p
91-110, 7 fig, 15 ref.

Descriptors: *Water pollution sources, *Ground-water pollution, *Agriculture, *Saline water intru-sion, Groundwater, Plant growth.

Ground water quality is related to agricultural activities. Saltwater intrusion is one type of ground water quality impact related to agricultural activity. Agricultural activities promote saltwater intrusion in three different ways. One involves overpumping of fresh water in coastal and tidal areas, or from aquifers which overlay, underlay, or occur adjacent to saline water. The second way is through inadequate water well construction which results in leaking wells that promote mixing of fresh and saline water. Finally, agricultural practices which change the composition of local root systems from expanded throughout the soil profile to only shallow roots allow increased percolation of water through soluble salts in the soil. Saltwater intrusion can impact agricultural activities by decreasing crop yield, completely eliminating the health of domestic livestock. The salt content of soils has been shown to be related to the potential for erosion. There are numerous ways in which saltwater intrusion can be controlled or managed. Some solutions are simple, such as controlling numpace rates, straticular leaving withdrawal Ground water quality is related to agricultural saltwater intrusion can be controlled or managed. Some solutions are simple, such as controlling pumpage rates, strategically locating withdrawal wells, or the sealing of leaking wells. Other solutions are more complicated and costly: artificial recharge, extraction wells, or desalination represent techniques which are applicable primarily on a regional basis. (See also W89-02654) (Davis-PTT) W89-02665.

SOIL TESTING AS A GUIDE TO PRUDENT USE OF NITROGEN FERTILIZERS IN OKLA-HOMA AGRICULTURE

Oklahoma State Univ., Stillwater. For primary bibliographic entry see Field 7B. W89-02664

EFFICIENT NITROGEN FERTILIZATION IN AGRICULTURAL PRODUCTION SYSTEMS, Oklahoma State Univ., Stillwater. Dept. of Agron-

R. L. Westerman. IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p. 137-151, 3 fig, 10 tab, 14 ref.

Descriptors: *Water pollution prevention, *Crop production, *Nitrogen cycle, *Agriculture, *Ferproduction, *Nitrogen cycle, *Agriculture tilizers, Nitrogen, Oklahoma Groundwater.

Nitrogen fertilization in agricultural production systems, especially in Oklahoma, is discussed. Nitrogen usage in Oklahoma declined to 250,000 metric tons, from the high of 274,000 metric tons in 1978-1979. Most of the nitrogen utilized was anhy-1978-1979. Most of the introgen utilized was anny-drous ammonia applied to winter wheat and was deep placed in soil at the time of application. Losses due to erosion or runoff were minimal. Nitrogen in soil is in constant turnover between organic and inorganic nitrogen forms. Extensive research utilizing nitrification inhibitors failed to increase yields or nitrogen uptake in crops. Leach-

ing of fertilizer nitrate is not a major problem under climatic and rainfall conditions in most soils in Oklahoma. Yields are often reduced because of in Oklahoma. Yields are often reduced because of lack of rainfall and significant quantities of water does not pass through the soil profile. Split nitrogen applications and the method of fertilizer placement have not been shown to increase yield or nitrogen use efficiency in most agricultural production systems in Oklahoma. However, there may be some economic advantages to split applications of nitrogen to allow hedging on climatic factors which may affect yield. The most effective management tool for minimizing the potential for nitrate contamination of groundwater and streams is the use of the soil nitrate-nitrogen test as a guide for nitrogen fertilizer recommendations. The primary objective of most soil fertilizer researchers is for nitrogen fertilizer recommendations. The pri-mary objective of most soil fertilizer researchers is mary objective of most soil fertilizer researchers is to supply the crop with adequate nutrients to produce maximum economic yields, yet not in excess to minimize the potential for nitrate contamination of groundwater and streams. Since nitrogen usage is increasing annually nationwide, research efforts to maximize nitrogen uptake in crops need to be intensified. (See also W89-02654) (Davis-PTT) W89-02665

NITRATES AND PESTICIDES IN GROUND WATER: AN ANALYSIS OF A COMPUTER-BASED LITERATURE SEARCH,

Oklahoma Univ., Norman. Environmental and Ground Water Inst.

Ground Water Inst.
L. W. Canter.
IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p. 153-174, 5 tab, 63 ref.

Descriptors: *Groundwater pollution, *Nitrates, *Literature review, Information retrieval, *Agriculture, *Fertilizers, *Pesticides, Nitrogen, Mathematical models, Groundwater.

A review of nitrates and pesticides in groundwater was determined through an analysis of a computer-based literature search, using the DIALOG System. Ten data bases were used. Key descriptor words used in the search were: pesticides, nutrients, herbicides, inscettides, fertilizers, and groundwater. A total of 1,317 abstracts was obtained. 63 abstracts were selected for summarization. Nitrates were addressed in 34 abstracts, and pesticides in 29 abstracts. Nitrate contamination of fertilizers from agricultural amplication of fertilization. tion. Nitrates were addressed in 34 abstracts, and pesticides in 29 abstracts. Nitrate contamination of groundwater from agricultural application of fertilizers is a wide-spread problem in the United States. Nitrate concentrations in groundwater may exceed the recommended drinking water standard of 10mg/L nitrates as nitrogen. Many factors influence nitrate concentrations in groundwater, including the timing and rate of fertilizer application, subsurface soil characteristics, depth to groundwater, crop nutrient need, the timing and rate of irrigation, and natural rainfall. Nitrate minimization in groundwater can be achieved through water application management twia irrigation system selection and irrigation scheduling, fertilizer application management through control of the timing and amounts of fertilizer usage, and the use of nitrification inhibitors. Agricultural applications of pesticides are causing pesticide contamination of groundwater. Many factors influence pesticide concentrations in groundwater, including the mobility and persistence characteristics of the pesticide used, the timing and rate of irrigation, and natural rainfall. Pesticide inhimization in groundwater can be achieved through water application management. Mathematical models have been developed for predicting nitrate and pesticide concentrations in groundwater. (See also W89-02654) (Davis-PTT)

BEHAVIOR AND SUBSURFACE TRANSPORT OF AGROCHEMICALS IN CONSERVATION SYSTEMS,

Agricultural Research Service, El Reno, OK. T. H. Dao.

IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p

175-184, 6 tab, 16 ref.

Descriptors: *Path of pollutants, *Agricultural chemicals, *Agriculture, *Fertilizers, Herbicides, Ammonium, Conservation, Groundwater, Water pollution prevention, Pesticides.

A comparative study of the transformation of ammonium nitrate showed that soluble nitrogen was tied up in the residue layer which behaved as a controlled-release source. The result was a less rapid loss of fertilizer by leaching out of the root zone, enhancing the effectiveness of fertilizer and indigenous soil nitrogen for crop production. Disappearance of the herbicide BAY SMY 1500 from the surface 10 cm of soil was more rapid with no tillage treatment as compared to sub till and plowed treatments. Higher volumetric water contents in surface soil contributed to an optimal plowed treatments. Higher volumetric water contents in surface soil contributed to an optimal growth environment for microbial decomposers. The ecological differences at the soil surface between cleantill and conservation till systems affected the behavior and subsurface transport of these agrochemicals to reduce the potential risks to groundwater quality. The surface microenvironmental differences demonstrate the need for new management practices for agrochemical inputs. The safeguarding of ground water resources from the potential contamination by agricultural chemicals depends upon the management practices in place at the soil surface, just as much as on the natural hydrologic processes acting upon the conpiace at the soil surface, just as much as on the natural hydrologic processes acting upon the con-taminant, once it has migrated into the subsurface environment. Conservation tillage practices may be the best production practices to protect ground-water resources. (See also W89-02654) (Davis-PTT W89-02667

IMPACTS OF AGRICULTURAL CHEMICALS ON GROUND WATER QUALITY IN IOWA.

ON GROUND WALER QUALITY IN IOWA, Geological Survey, Iowa City, IA. R. D. Libra, G. R. Hallberg, and B. E. Hoyer. IN: Ground Water Quality and Agricultural Prac-tices. Lewis Publishers, Chelsea, Michigan. 1987. p 185-215, 18 fig, 5 tab, 18 ref.

Descriptors: *Water quality, *Groundwater pollution, *Agricultural chemicals, *Water pollution sources, *Iowa, *Agriculture, *Fertilizers, Pesticides, Nitrate, Groundwater.

cides, Nitrate, Groundwater.

The Iowa Geological Survey investigated the impact of agricultural chemicals, specifically nitrogen fertilizers and pesticides, on groundwater. Much of the work has focussed on the Big Spring Ground Water Basin area of northeast Iowa. The susceptible hydrogeologic settings include karst areas where aquifers lie close to the land surface and alluvial aquifers. The presence of significant concentrations of nitrate and low, yet persistent and possibly increasing concentrations of pesticides in groundwater drinking water supplies concern the environment and public health. Where sufficient thicknesses of low permeability materials protect underlying aquifers, contaminants are still leaching to groundwater, but this shallow groundwater generally moves laterally, discharging to streams, rather than vertically to aquifers used as drinking water sources. The magnitude of nitrogen as drinking water sources. The magnitude of nitrogen as environmental implications. Data from Big Spring and many experimental station farms, in the upper midwest indicate that corn crops are not utilizing 50 percent or more of the nitrogen applied. Such inefficiencies in fertilizer utilization suggest an area for improvement and economic gain. Groundwater quality problems related to agriculture can be resolved through a holistic approach to agricultural management and research. (See also W89-02668) (Davis-PTT)

ASSESSMENT OF EMPIRICAL METHOD-OLOGIES FOR PREDICTING GROUND WATER POLLUTION FROM AGRICULTURAL

CHEMICALS, Environmental Protection Agency, New York. Region II. D. S. Curry.

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B-Sources Of Pollution

IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p 227-245, 6 fig, 5 tab, 7 ref.

Descriptors: *Path of pollutants, *Groundwater pollution, *Agricultural chemicals, *Agriculture, *Fertilizers, Pesticide, *Computer models, Groundwater, Prediction, Model studies, Comput-

The DRASTIC and LEACH Methodologies were applied to the Big Spring Ground Water Basin in northeastern Iowa in an attempt to predict groundnortheastern Iowa in an attempt to predict ground-water pollution from agricultural chemicals. These are two methodologies, developed by the U.S. Environmental Protection Agency, evaluate the probability of agricultural chemicals contaminating the groundwater in any location of interest. DRASTIC focuses on classic hydrogeologic pa-rameters. LEACH concentrates on the movement of pesticides through soil. The methodologies did not correlate with the field data. (See also W89-02654) (Davis-PTT) W89-02670

INVESTIGATION OF NITRATE CONTAMINA-TION IN SHALLOW GROUND WATERS NEAR WOODWARD, OKLAHOMA, Oklahoma Water Resources Board, Oklahoma

City. B. K. Gopal.

IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p 247-264, 11 fig, 2 tab, 10 ref.

Descriptors: *Oklahoma, *Nitrates, *Groundwater pollution, *Agriculture, *Fertilizers, Irrigation, Leachates, Groundwater.

The nature of the sources which contributed to the Ine nature of the sources which contributed to the high nitrate levels in the groundwater around Woodward, Oklahoma, was determined. The area is west and southwest of the city of in a predominantly rural area of 315 square miles. Row crop farming is common. Rainfall averages 28 inches per year. Groundwater occurs principally in the terrace descripts and alluvium in the valley of the per year. Groundwater occurs principally in the terrace deposits and alluvium in the valley of the North Canadian River and its major tributaries: Wolf, Indian, Persimmon, and Bent Creeks; and in the Ogallala Formation which covers the southwestern part of the county. Wells have been a primary source of water. There were large and frequent changes in nitrate concentrations between monthly samples, due to the introduction of industrial wastewater in the vicinity of a new pond, which is upgradient from the wells. Nitrate levels were usually high in the spring, decreaed during the summer, and increased in the fall. A steady increase in nitrate concentrations throughout the sampling period was due to past activity. The sampling period was due to past activity. The nitrate problem in the majority of Woodward wells sampled in 1982 was created during rainfall events by nitrate sources leaching into the highly permeable soil. It is recommended that careful permeable soil. It is recommended that careful attention and planning be given to the proper agricultural practices involving the use of fertilizers, irrigation practices, livestock handling operations, and proper handling of industrial wastes. (See also W89-02654) (Davis-PTT) W89-02671

SALINE SEEP ON WHEATLAND IN NORTH-WEST OKLAHOMA,

Southern Plains Range Research Station, Wood-

Southern Plants Range Research Station, Woodward, OK.
W. A. Berg, C. R. Cail, D. M. Hungerford, J. W.
Naney, and G. A. Sample.
IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p
265-272, 2 fig. 3 tab, 9 ref.

Descriptors: *Groundwater management, *Water pollution sources, *Saline water intrusions, *Cropland, *Tile drains, *Oklahoma, *Wheat, Ground-

Observations on dryland-farm saline seeps which have developed over the past 5 to 20 years in western Oklahoma are reported. Most of the observations and all the data are from Harper County in northwest Oklahoma. Saline seeps in northwest

Oklahoma were not mentioned in the 1960 Harner County soil survey report, or in a 1962 review of saline-alkali soils in Oklahoma. The incidence and saline-aikaii soils in Okianoma. Ine incience and extent of saline seep increased over the 1975 to 1985 period. The size of saline seep areas in Harper County range from 5 to 100 ha in the lower landscape positions of 200 to 2000 ha watersheds underlain at shallow depths by Permian redbeds. The greater portion of affected watershed are in the county of the county cultivation for dryland wheat. It can hypothesized that saline seeps develop over tens of years from small increments of water percolation through culsmall increments of water percolation through cul-tivated soils and then move over relatively un-leached Permian redbeds to lower landscape posi-tions. Tile drain systems have been installed on five saline seep areas in Harper County. Two of the monitored tile drain systems ameliorated the saline seep condition. In these systems the annual drain-age through the tile is equivalent to 1.6 to 2.5 cm of precipitation over the watershed. The moni-tored tile drain system that did not ameliorate the saline seep condition removed 0.3 cm of water per tored tile drain system that did not ameliorate the saline seep condition removed 0.3 cm of water per year on a watershed bases. The discharge water contains concentrations of soluble salts which, in general, are greater than the saline concentrations in the local streams receiving the drainage. The saline seep problem in northwest Oklahoma appears similar to the extensive saline seep problem in the northern Great Plains. The immediate need of Oklahoma it to identify recherge serges and to in Oklahoma is to identify recharge areas and to manage these areas to use or discharge the precipitation before it moves through the root zone. Tile tation before it moves through the root zone. Tile drainage systems can ameliorate individual saline seeps. (See also W89-02654) (Davis-PTT) W89-02672

NATIONAL ASSESSMENT OF GROUND WATER CONTAMINATION FROM PESTI-

WATER CONTAMINATION FROM PESTI-CIDES AND FERTILIZERS, Oklahoma Univ., Norman. Environmental and Ground Water Inst. D. M. Fairchild.

Dr. Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p 273-294, 7 tab, 30 ref.

Descriptors: *Groundwater pollution, *Pesticides, Descriptors: "Groundwater pollution, "Pesticides, Or-Fertilizers, Surveys, Halogenated pesticides, Or-ganophosphorus pesticides, Carbamate pesticides, Triazine pesticides, Dinitrophenols, Arizona, Cali-fornia, Delaware, Florida, Kansas, Montana, New York, Rhode Island, South Dakota, Texas.

Current information on groundwater contamina-tion in the contiguous United States from the usage of pesticides and fertilizers is summarized. The specific pesticide contaminants investigated in-clude: EDB, aldicarb, DDT, atrazine, alachlor, chlordane, tebuthiuron, phorate, carbaryl, toxa-phene, endrin, pordon, allanine, lindane, and ar-senic. In the state of Arizona, nitrates occur natu-rally, at concentrations as high set 400 pers. rally at concentrations as high as 400 ppm. The state of California is a large user of groundwater and agricultural chemicals. Agriculture and pouland agricultural chemicals. Agriculture and pour-try wastes are the major sources of contamination in Delaware. The University of Delaware is in-volved in a regional study of pesticide leaching in groundwater with Penn State and Cornell Univergroundwater with Penn State and Cornell Univer-sity. Florida is one of the most aware states in the nation regarding agricultural chemical contamina-tion of groundwater. Great interest is focused on EDB (750 ppd) and aldicarb (1200 ppd) along the Florida Ridge. Ammonia, strazine, and alachlor have been found in public supply wells near co-opnave ocen round in public supply wells near co-op-storage areas and in association with spills in Kansas. Some groundwater quality is monitored cooperatively by U. S. Geological Survey and the Montana Department of Agriculture, but pesti-cides are not analyzed. Aldicarb and nitrate contamination have been the major problems in New York. High nitrate levels have been found in the shallow aquifers in Oklahoma. Aldicarb contami-nation has occurred in the potato growing areas in nation has occurred in the potato growing areas in the shallow outwash and till aquifers of Rhode Island. A total of 300 private and 7 public wells have been contaminated by various sources across the state. Some pesticide and nitrate contamination due to fertilizers, animal waste, and septic tanks has been recognized in South Dakota. In Texas there have been numerous isolated incidents of groundwater contamination by pesticides. Thirty-three states reported pesticides as a confirmed or suspected groundwater contaminant. Nitrates in suspected groundwater contaminant. Nutrates agroundwater are regulated under stricter standards than pesticides. There is a lack of communication between separate agencies handling groundwater contamination and data gathering. (See also W89-02654) (Davis-PTT)

QUANTITATIVE STUDIES OF BIODEGRADA-TION OF PETROLEUM AND SOME MODEL HYDROCARBONS IN GROUND WATER AND SEDIMENT ENVIRONMENTS,

Bemidji State Univ., MN. Center for Environmen-

F. Chang, M. Hult, and N. N. Noben.

In: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p 295-318, 6 fig, 8 tab, 29 ref.

Descriptors: *Fate of pollutants, *Soil contamina-tion, *Groundwater pollution, *Biodegradation, *Oil spills, *Microbial degradation, Oil hydrocar-bons, Groundwater.

The impact of various environmental parameters on biodegradation of crude oil and model hydrocarbons in simulated subsurface environments wa studied. Samples were collected from the follow studied. Samples were collected from the follow-ing localities: control samples of uncontaminated outwash sand from both water unsaturated and saturated zones near the oil-spill site; uncontamin-ated groundwater 4 ft below the water table; and contaminated samples from both unsaturated and saturated zones at the oil-spill site near Bemidji, Minnesota. Eight bacteria and four fungi were isolated from groundwater and sediment from the oil-spill site. Mineralization of the oil in contami-nated tooseil and equifer sediment by indigenous soluted from groundwater and sediment from the oil-spill site. Mineralization of the oil in contaminated topsoil and aquifer sediment by indigenous microorganisms of the oil-spill site at 22C show that both topsoil and aquifer sediment are mineral nutrient deficient, especially in the aquifer sediment. All the model hydrocarbons are subjected to biodegradation in the subsurface aquifer environments by indigenous mixed microbial populations. Some preference was shown for degradation or crude oil and n-hexadecane, although degradation rates were reduced significantly at lower temperatures. Hydrocarbon biodegradation was limited by the nutritional imbalance between the substrate carbon, nitrogen, and phosphorous required for microbial growth. A rise in temperature creates a rise in metabolic activity of microbial communities in both aerobic and microaerobic conditions. Aprise in metabolic activity of microbial communities in both aerobic and microaerobic conditions. Application of the radioisotope C34-1-hexadecane to sediment samples collected from the aquifer indicated that hydrocarbon-degrading microorganisms are ubiquitous. They were found in sediment and groundwater in both upgradient uncontaminated and down-gradient contaminated and down-gradient contaminated degradative potential for crude oil and model hydrocarbon; in sediment and groundwater semious products and sequential for crude oil and model hydrocarbon; in sediment and groundwater semious products. drocarbons in sediment and groundwater samples was a function of the numbers of mixed indigenous isolates present in the aquifer. Microbial degradation of crude oil and model hydrocarbons was enhanced by an increase in temperature, oxygen availability, and inorganic nutrient concentration. Biodegradation of hydrocarbons in a contaminated Biodegradation of hydrocarbons in a contamnated aquifer may be important in affecting the transport of aliphatic and low molecular weight hydrocarbons but is probably less important for the larger polynuclera aromatic compounds. (See also W89-02654) (Davis-PTT)

INTERACTIVE SIMULATION OF CHEMICAL MOVEMENT IN SOIL,
Oklahoma State Univ., Stillwater. Dept. of Agron-

Omy.

D. L. Nofziger, and A. G. Hornsby.

IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p
319-328, 3 fig. 3 tab, 5 ref.

Descriptors: *Path of pollutants, *Soil chemistry, *Simulation analysis, *Hydrologic models, *Model studies, Soil properties, Groundwater.

A model is presented that was developed as a management tool and as an educational aid for people managing soil-applied chemicals; designed

Sources Of Pollution-Group 5B

for use with readily available soil, chemical, and weather data; and to simulate chemical movement and display graphical or tabular results. The foland display graphical or tabular results. The fol-lowing assumptions are used in the model: chemi-cals move only in the liquid phase in response to movement of soil water; all soil water participates in the transport process; water entering the soil redistributes instantaneously to field capacity; water is removed by evapotranspiration from each layer in the root zone in proportion to the relative amount of water available in that layer; upward movement of water does not occur anywhere in the soil profile: the adsorption process can be movement of water does not occur anywhere in the soil profile; the adsorption process can be represented by a linear, reversible, equilibrium model; and the half-life for biological degradation of the chemical is constant with time within a soil layer. Simulation of chemical movement in soils requires the selecting of soil and chemical of interest, the depth of application of the chemical, the depth of the root zone for the crop being grown on the site, daily evapotranspiration and infiltration records for the period of time being simulated, and the selection of English or metric units for computational control of the period period of the period of the period of the period the selection of English or metric units for computed results. The complete system enables the user to enter soil and chemical parameters and weather information for the site of interest. The user may then simulate the movement of the chemical at that site under natural rainfall or under different irrigation schemes. The results aid in water management decision. The user may also use the model to monitor movement of the chemical and as an aid in determining the need for additional application of the chemical. If several chemicals are available for the same purpose, the manager may compare their movement and degradation and include this information in the selection process. (See also W89-02675

NORTH ALABAMA WATER QUALITY AS-SESSMENT, VOLUME VIII - WATER QUAL-ITY MODELING,

Tennessee Valley Authority, Norris. Engineering

Tennessee Value 1 No. Lab.

J. L. Vadnal, and M. L. Poe.
Available from the National Technical Information
Service, Springfield, VA. 22161, as DE87-900604.
Price codes: A04 in paper copy, A01 in microfiche.
Report No. WR28-4-590-125. TVA/ONRED/
AWR-86/46, July 1986. 54p, 3 fig, 15 tab, 23 ref.

Descriptors: *Water pollution sources, *Alabama, *Tennessee River, *Water quality, *Model studies, *Water pollution effects, Wheeler Reservoir, Wilson Reservoir, Pickwick Reservoir, Agricultural runoff, Rivers, Nutrients, Nonpoint pollution sources, Nitrogen, Phosphorus, Herbicides, Pesticides.

The Tennessee Valley Authority's study of water quality in the Tennessee River in North Alabama consists of a tiered, four-phase approach based on the degree of contamination found to develop and promote mitigation of any unsatisfactory conditions. This report is of these them. tions. This report is a component of phase three. It summarizes the results of point source and non-point source evaluations of the potential for water quality impacts. The objectives of these evalua-tions were: (1) to define the potential for adverse tions were: (1) to define the potential for adverse impacts of point source waste discharges on Wheeler, Wilson, and Pickwick Reservoirs, and (2) to determine the potential for adverse impacts from the runoff from agricultural watersheds on the water quality of Wilson and Pickwick Reservoirs. The results presented here show that point voirs. Incressurs presented here show that point source discharges could have an impact on the water quality at water intakes and recreational areas in the Wheeler and Pickwick Reservoirs, especially for cases where the contaminant was released from a river bank that had water intakes or recreational areas along the same bank farther downstream. Evaluation of the potential for addownstream. Evaluation of the potential for adverse impacts from nonpoint source runoff was limited to nitrogen, phosphorus, and herbicides, but did not consider sediment, which is known to be a problem in agricultural areas. No data on pesticides were available, but an equation and information from local agricultural extension agents were used to predict that average, edge-of-field concentrations could be as high as 22,000 ppb. (Lantz-PTD)

EVALUATION OF RAIN CHEMISTRY DATA FOR THE JOHN F. KENNEDY SPACE CENTER, FLORIDA AND THE UNIVERSITY OF CENTRAL FLORIDA, ORLANDO, FLORI-

University of Central Florida, Orlando. Dept. of Chemistry.

For primary bibliographic entry see Field 4C. W89-02708

PESTICIDE IMPACT ON STREAM FAUNA WITH SPECIAL REFERENCE TO MACROIN-

Royal Holloway and Bedford New Coll., Egham

For primary bibliographic entry see Field 5C. W89-02773

ACIDIFICATION OF FRESHWATERS,

Aberdeen Univ. (Scotland). Dept. of Soil Science. M. Cresser, and A. Edwards. Cambridge University Press, New York. 1987. Cambridge Environmental Chemistry Series. 136p.

Descriptors: *Air pollution effects, *Acidification, *Natural waters, *Acid rain, *Acidity, Biological properties, Physical properties, Chemical properties, Geohydrology, Botany, Forestry, Microbiological studies, Meteorology, Water quality, Hydrogen ion concentration, Research priorities.

Numerous interacting physical, chemical, and biological processes regulate the acidity of freshwaters. Natural acidification processes are considered first, then the effects of acidifying pollutant inputs from the atmosphere and of other human activities. The relative importance of the different processes is critically examined. Concepts incorporated are drawn from chemistry, physics, geology, hydrology, plant science and forestry, soil science, microbiology and meteorology. The importance of freshwater acidification, natural acidification processes, anthropogenic influences on acidification processes, anthropogenic influences on acidification research, and possible priorities in freshwater acidification research, are the primary divisions within which these concepts are discussed. (Lantz-PTT) W89-02774 W89-02774

ORGANIC CHEMICALS IN NATURAL WATERS: APPLIED MONITORING AND IMPACT ASSESSMENT,

Alberta Environmental Centre, Vegreville For primary bibliographic entry see Field 5C. W89-02776

SUPERFUND RECORD OF DECISION: DISTLER FARM, KY.

Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response. For primary bibliographic entry see Field 5G. W89-02778

ACID PRECIPITATION. CITATIONS FROM THE COMPENDEX ENGINEERING INFOR-MATION INC. DATABASE (SEPT 84 - AUG 86). National Technical Information Service, Spring-

Available from the National Technical Information Service, Springfield, VA. 22161, as PB87-866612. Price codes: N01 in paper copy, N01 in microfiche. September 1987. 137p.

Descriptors: *Acidification, *Air pollution effects, *Bibliographies, *Acid rain, *Water pollution sources, Literature review, Precipitation, Water pollution effects, Air pollution, Measuring instruments, Chemical analysis.

This bibliography contains citations concerning the causes, effects, sources, and control of acid precipitation and acidification. Techniques and technology for measurement and analysis of acid precipitation are considered. This updated bibliography contains 317 citations. (Author's abstract) W89-02784

ACID PRECIPITATION. CITATIONS FROM THE COMPENDEX ENGINEERING INFOR-MATION INC. DATABASE (SEPT 86 - AUG 87). National Technical Information Service, Spring-field, VA.

Available from the National Technical Information Service, Springfield, VA. 22161, as PB87-866620. Price codes: N01 in paper copy, N01 in microfiche. September 1987. 115p.

Descriptors: *Acidification, *Bibliographies, *Acid rain, *Water pollution sources, Literature review, Precipitation, Water pollution effects, Air pollu-tion, Measuring instruments, Chemical analysis.

This bibliography contains citations concerning the causes, effects, sources, and controls of acid precipitation and acidification. Techniques and technology for measurement and analysis of acid precipitation are considered. This updated bibliography contains 266 citations, all of which are new. (Author's abstract) W89-02785

PROCESSES, COEFFICIENTS, AND MODELS FOR SIMULATING TOXIC ORGANICS AND HEAVY METALS IN SURFACE WATERS,

Iowa Univ., Iowa City. Dept. of Civil and Envi-ronmental Engineering.

J. L. Schnoor, C. Sato, D. McKechnie, and D.

Sanoo.

Available from the National Technical Information Service, Springfield, VA. 22161, as PB87-213880.

Price codes: Al4 in paper copy, A01 in microfiche. Report No. EPA/600/3-87/015, June 1987. 303p, 52 fig. 52 tab, 316 ref, 2 append. EPA Contract 811756.

Descriptors: *Path of pollutants, *Organic compounds, *Heavy metals, *Surface water, *Model studies, *Fate of pollutants, *Simulation analysis, Literature review, Mathematical models, Natural

waters.

The primary purpose of this document is to assist potential users in selecting proper models and to supply a literature review of rate constants and to supply a literature review of rate constants and to supply a literature review of rate constants and coefficients, to insure the wise application of the models. The manual describes basic concepts of fate and transport mechanisms, providing kinetic formulations that are common to these models and analytical solutions to the equations are demonstrated. The manual includes a brief general description of four models (EXAMS II, TOXIWASP, HSPF, and MINTEQ), example runs, and comparisons of these models. Rates and coefficients provided in the manual were collected through literature reviews through 1986. (Author's abstract) abstract) W89-02788

ACID PRECIPITATION LITERATURE REVIEW 1986: EMISSION, TRANSPORT, TRANSFORMATION AND DEPOSITION OF ACIDIC TRACE SPECIES, Norsk Inst. for Luftforskning, Lillestroem.

O. Hov. Available from the National Technical Information Service, Springfield, VA. 22161, as DE88-751208. Price codes: A04 in paper copy, A01 in microfiche. Report No. NILU-OR-34/87, May 1987. 54p, 3 fig, 1 tab, 125 ref.

Descriptors: *Trace elements, *Acid rain, *Litera-ture review, *Fate of pollutants, *Path of pollut-ants, Nitrogen compounds, Ammonia, Nitrates, Sulfur, Sulfates, Air pollution effects.

More effort is being devoted to the investigation of the atmospheric distribution and chemistry of compounds derived from nitrogen oxides and ammonia, and from biogenic sulfur compounds. The annual deposition of nitrate and ammonium in southern Scandinavia is about 15 kg/ha as NO3(-)-N and NH4(+)-N, while it is about 15 kg/ha as SO4-S. Both in Europe and North America there is an

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B-Sources Of Pollution

extensive effort put into model calculations of acid deposition. A new version of the EMEP-model was used to calculate the sulfur budget for Europe was used to calculate the surfur budget for Europe for several years. The country-by-country budget for sulfur is quite different from the results of earlier versions of the model. The new calculation fits better with observations. On a national basis, 28 kt/yr of sulfur is emitted in Norway. Some results from the calculation of ozone in episodes over Europe have been published using the PHOXA-model. The calculation indicates that changes in the emissions of NOx and VOC mainly will move areas of maximum ozone rather than lowering the maximum concentration. Substantial reductions in NOx- and VOC-emissions are needed to obtain a significant ozone reduction over Europe in epi-sodes. (See also W89-02827) (Lantz-PTT) W89-02822

REVIEW OF PAPERS PUBLISHED IN 1985 ABOUT EMISSION, TRANSPORT, TRANS-FORMATION AND DEPOSITION OF ATMOS-PHERIC TRACE CONSTITUENTS OF IMPOR-TANCE FOR ACID DEPOSITION,

Norsk Inst. for Luftforskning, Lillestro

O. Hov. Available from the National Technical Information Service, Springfield, VA 22161, as DE88-751200. Price codes: A04 in paper copy, A01 in microfiche. Report No. NILU-TR-3/86, February 1986. 61p, 193 ref.

Descriptors: *Literature review, *Water pollution sources, *Acid rain, *Air pollution, Ozone, Nitrates, Hydrocarbons, Organic compounds, Methne, Carbon monoxide, Europe

About 300 papers published in 1985 or late in 1984 about three-dimensional models being developed to describe episodes of elevated levels of air pollution related to acid deposition were reviewed. There has been progress in the development of models for acid deposition and photochemical oxidants. Simultaneous measurements of O3, NOx, individual hydrocarbons, aldehydes, CO and OH have led to the conclusion that the atmospheric gas chemistry in moderately polluted air is well understood. There is an upward trend over Europe in the concentration of methane, CO and O3. (See also W89-02823) (Author's abstract) W89-02827

INTENSIVE SURVEY OF THE DUPAGE RIVER BASIN, 1983. Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control. For primary bibliographic entry see Field 5G. W89-02829

NEARSHORE TRANSPORT PROCESSES AF-FECTING THE DILUTION AND FATE OF ENERGY-RELATED CONTAMINANTS,

Skidaway Inst. of Oceanography, Savannah, GA J. O. Blanton. Available from the National Technical Information Available from the National Technical Information Service, Springfield, VA 22161, as DE88-003199. Price codes: A03 in paper copy, A01 in microfiche. Report No. DOE/ER/60351—T3, December 1, 1987. 26p, 7 fig, 1 tab. DOE Contract DE-FG09-85ER60351.

Descriptors: *Fate of pollutants, *Path of pollutants, *Nearshore processes, Literature review, Coastal waters, Salinity.

Progress over a 3-year period between January, 1985 to December, 1987, on a contract which is one of several components in the DOE regional program of Coastal Oceanography in the south-eastern U.S., called the South Atlantic Bight (SAB) is summarized. Low salinity coastal waters were monitored during autumn 1986 and hydroscabilings and the coastal waters were monitored during autumn 1986 and hydroscabilings and the coastal waters and the coastal waters are considered to the coastal graphic mapping was conducted south of the coastal boundary zone (CBZ). The results were constant bothwary zone (CBL). The results were used to design experiments conducted in 1987 and scheduled to be performed during the next 5 yrs. The removal of materials, including pollutants, from the CBZ involves the interaction of physical, geochemical, and biological processes. Hence, the field work requires close coordination between

biologists and physical-chemical oceanographers. Research objectives include the determination of transport pathways and volume flow rates in the CBZ and the development of models to quantify transport due to physical processes in the CBZ.
Further progress is limited by lack of knowledge
of the vertical profile of horizontal currents in the shallow waters of the continental shelf. Abstracts of papers describing the work are included. (Lantz-W89_02843

MARYLAND SYNOPTIC STREAM CHEMISTRY SURVEY: ESTIMATING THE NUMBER AND DISTRIBUTION OF STREAMS AFFECT-ED BY OR AT RISK FROM ACIDIFICATION, International Science and Technology, Inc.,

International Science and Technology, Inc., Reston, VA.
C. M. Knapp, and W. P. Saunders.
Available from the National Technical Information Service, Springfield, VA. 22161, as PB88-213996.
Price codes: A10 in paper copy, A01 in microfiche. Report No. AD-88-2, April 1988. 212p, 47 fig, 27 tab, 79 ref, 6 append. Maryland Department of Natural Resources Contract PR87-071-02.

Descriptors: *Water pollution sources, *Chemical analysis, *Fate of pollutants, *Streams, *Acidifica-tion, *Maryland, Acid rain, Headwaters, Fish, Path of pollutants, Hydrogen ion concentration, Conductivity, Organic carbon, Surveys.

The Maryland Synoptic Stream Chemistry Survey The Maryland Synoptic Stream Chemistry Survey was designed to provide statewide estimates of the number and extent of stream resources presently affected by or at risk from acidification. Streams surveyed were selected as a stratified random sample from a statewide list of non-tidal stream reaches. The sample represented water quality conditions in a population of interest comprising the state's headwater (watershed areas < or = 100 the state's headwater (watershed areas < or = 100 sq km) stream resources sampled during relatively sq km) stream resources sampled during relatively constant phenological conditions during the spring of 1987. Of the 6875 non-tidal stream reaches in the state, an estimated 5411 reaches belong to the population of interest. Samples were analyzed for acid neutralizing capacity (ANC), pH, conductivity, dissolved organic carbon (DOC), color, and dissolved inorganic carbon (DIC), using analytical methods developed for the EPA National Surface Water Survey. Population estimates of the number and total length of stream reaches at or below specific levels of acid neutralizing capacity (ANC) and total length of stream reaches at or below specific levels of acid neutralizing capacity (ANC) or pH were developed using data from 535 ran-domly sampled stream reaches. In the Coastal Plain portion of the state, an estimated 1977 stream km had pH values of 6.5 or lower (values that may cause decreased reproductive success in anadro-mous fish that utilize Coastal Plain streams). In upland portions of the state, 283 stream km had pH values of 6.0 or lower (values that may cause values of 0.0 or lower (values that may cause decreased reproductive success of resident native fish populations). Based on a sensitivity criterion of ANC < or = 200 microeq/L, approximately one-third (32%) of all stream reaches (nearly 4200 stream km) are potentially sensitive to acidification or already acidified. Sensitive streams are present in all physiographic provinces in Maryland; the highest proportions are found in the South Coastal Plain (74%) and the Appalachian Plateau (52%). (Author's abstract)

FISCAL YEAR 1985 SUMMARY REPORT OF NOAA METEOROLOGY DIVISION SUPPORT TO THE ENVIRONMENTAL PROTECTION AGENCY.

AGENCY.

National Oceanic and Atmospheric Administration, Rockville, MD. Air Resources Labs.

Available from the National Technical Information
Service, Springfield, VA. 22161, as PB88-179866.

Price codes: A04 in paper copy, A01 in microfiche.
NOAA Technical Memorandum ERL ARL-160,
November 1987, 54p, 2 fig, 1 tab, 108 ref, 4
append. Edited by Herbert J. Viebrock and Evelyn
M. Poole-Kober.

Descriptors: *Acid rain, *Air pollution, *Meteorology, *Model studies, Precipitation, Simulation analysis, Field tests, Hydrologic properties, Hydrology, Pollutant transport, Convective precipita-tion, Air pollution, Data collections.

The Meteorology Division provided meteorological research and support to the Environmental Protection Agency. Basic meteorological support consisted of the application of dispersion models, and the conduct of dispersion studies and model consisted of the application of dispersion models, and the conduct of dispersion studies and model evaluations. The primary research effort was the development and evaluation of air quality simulation models using numerical and physical techniques supported by field studies. Modeling emphasis was on the dispersion of photochemical oxidants and particulate matter on urban and regional scales, dispersion in complex terrain, and atmospheric processes related to the acid deposition problem. Highlights during FY-1985 included evaluation of the dividing streamline height concept for flow over and around terrain features; completion of the VALMET and MELSAR models for use in specific terrain situations; development of a preliminary version of the Regional Acid Deposition Model (RADM); completion of a mesoscale acid precipitation study; conduct of a Acid Deposition Model (RADM); completion of a mesoscale acid precipitation study; conduct of a field study of the transport and transformation of acidic compounds by non-precipitating cumulus convective processes; and completion of a position paper on the research status and needs on diffusion in atmospheric boundary layers. Work underway in other areas of air pollution meteorology and modeling is also described. (Author's abstract) W89-02857

STUDIES OF THE MECHANISMS AND RATES WITH WHICH NITROGEN SPECIES ARE INCORPORATED INTO CLOUD WATER AND PRECIPITATION, Washington Univ., Seattle. Dept. of Atmospheric

Science

D. A. Hegg, and P. V. Hobbs. D. A. Hegg, and F. V. Hooos. Available from the National Technical Information Service, Springfield, VA. 22161, as PB88-193065. Price codes: A04 in paper copy, A01 in microfiche. December 1987. 50p, 19 fig, 6 tab. Cloud and Aerosol Research Group Project AP-7(1-86).

Descriptors: *Air pollution, *Acid rain, *Nitric acid, *Nitrates, *Water pollution sources, *Nitrogen compounds, Cloud water, Precipitation, Ice, Snow, Chemical analysis.

Snow, Chemical analysis.

This report summarizes work carried out by the University of Washington's Cloud and Aerosol Research Group during the past year on the interactions of nitrogen species with clouds. The principle conclusions that have emerged from these analyses of the field data collected in the previous two years, are: (1) Nitrate production commonly occurs in clouds, and at times it is a source for nitrate in clouds that is comparable to that which derives from the scavenging of pre-existing nitrates. However, nitrate production in clouds is highly variable and does not appear to be either as frequent or as substantial as sulfate production; (2) The efficiencies with which nitrogen species are scavenged by clouds is strongly influenced by the precipitation formation mechanism and, in particular, by the presence and growth mechanisms for ice and snow; (3) A possible mechanism for nitrate production in clouds is the interstitial formation of NO3 and N2O5. Although the data set is not inconsistent with this mechanism, it is not extensive or definitive enough to confirm it; and (4) Peroxyacetyl nitrate (PAN) is poorly scavenged by clouds. The study shows the value of analyzing chemical data sets gathered during comprehensive by clouds but it can be registributed in the vertical by clouds. The study shows the value of analyzing chemical data sets gathered during comprehensive meteorological field experiments to allow evaluation of the complex interactions of meteorological and chemical parameters. The authors recommend that high priority be given to the continued development. opment of sensitive, fast-response analyzers for NOx species that are suitable for use aboard aircraft. (Lantz-PTT) W89-02862

LAKE MICHIGAN WATER QUALITY REPORT JANUARY THROUGH DECEMBER, 1986. Chicago Dept. of Water, IL. Water Quality Sur-veillance Section.

Available from the National Technical Information Service, Springfield, VA. 22161, as PB88-185871.

Sources Of Pollution-Group 5B

Price codes: A06 in paper copy, A01 in microfiche. Report No. IEPA/WPC/88-015, February 1988. 128p, 16 fig, 23 tab, 2 append.

Descriptors: *Lake Michigan, *Water quality, *Monitoring. Chemical analysis, Pentachlorophenol, Organic compounds, Ammonia, Nitrogen, Coliforms, Phosphates, Sulfates.

Coliforms, Phosphates, Sulfates.

Evaluation of the water quality of the southwest portion of Lake Michigan is based on standards as set by the Illinois Pollution Control Board (35 IL Adm Code 302). Total phosphate exceeded standards most often (31%) followed by phenols (26%), conductivity (10%), ammonia nitrogen (6%), sulfate (3%), chloride (1%) and fecal coliform (1%). Since it was not possible to collect the required number of fecal coliform samples within a 30 day period at each station, an individual count of 20/100 mL is used as a criterion. Total coliform counts in 1986 ranged from 0 to 470/100 mL with mean values of 0/100 mL, 5/100 mL and 75/100 mL for Open Water, North Shore and South Shore Surveys respectively. Fecal coliform counts in 1986 ranged from 0 to 142/100 mL. Ammonia nitrogen concentrations in 1986 ranged from 20.01 mg/L to 0.07 mg/L. Chloride concentrations in 1986 ranged from 9 to 12 mg/L. Sulfate concentrations in 1986 ranged from 20.00 mg/L to 31.00 mg/L. Pentachlorophenol was the only organochlorine compound detected in water samples in 1986. It was detected in two of six samples, with concentration of 0.004 micrograms/L, well below levels considered toxic detected in water samples in 1986. It was detected in two of six samples, with concentration of 0.004 micrograms/L, well below levels considered toxic to freshwater aquatic life and unsafe for public health protection (USEPA 1986). Total metals and cyanide were either below detection limits or within natural levels. These results are similar to those found since 1979. There continues to be a those found since 1979. There communes to be health advisory regarding consumption of Lake Michigan trout and salmon with lengths over 23 inches and 32 inches, respectively. (Lantz-PTT) W89-02867

PRELIMINARY ENVIRONMENTAL ASSESS-MENT OF THE CONTAMINATION ASSOCIATED WITH LAKE CALUMET, COOK COUNTY, ILLINOIS, Illinois State Water Survey Div., Savoy. Hazardous Waste Research and Information Center. P. E. Ross, M. S. Henebry, J. B. Risatti, T. J. Murphy, and M. Demissie.

Available from the National Technical Information Service. Springfield VA 22161, as PR88.18425

Available from the National Technical Information Service, Springfield, VA 22161, as PB88-184825. Price codes: A06 in paper copy, A01 in microfiche. Report No. HWRIC RR-019, February 1988. 142p, 42 fig. 28 tab, 134 ref, 4 append. Hazardous Waste Research and Information Center Contract

Descriptors: *Lakes, *Environmental effects, *Lake Calumet, *Path of pollutants, *Water pollution effects, *Illinois, Heavy metals, Organic compounds, Toxicity, Biodegradation, Bioaccumulation, Methane, Bioassay, Fate of pollutants.

Lake Calumet, located 15 miles south of down-Lake Calumet, located 15 miles south of down-town Chicago, is the vestige of a huge lake formed approximately 13,500 years ago from the meltwater of retreating glaciers. This environmen-tal profile focussed on the various basins within Lake Calumet proper. Study objectives were: (1) determination of the horizontal distribution of metals and organic contaminants in lake sediments;
(2) study of the physical transport of contaminants to study of the physical transport of contaminants by surface water and groundwater; (3) investigation of the fugacity of selected organic compounds in sediments and water; (4) determination of microbial degradation rates of toxic organic compounds; (5) estimation of metal bioaccumulation rates in (5) estimation of metal bioaccumulation rates in macrophytes; and (6) assessment of overall sediment toxicity by laboratory and field bioassays. Sediment samples were collected at 33 stations within the lake. Principal findings include: (1) concentrations of toxic metals and organics are generally far above background levels and higher than in nearby water bodies; (2) surface drainage into the lake is entirely through man-made channels; (3) wind-driven resuspension of sediment particles is continual; (4) methane production in sediments confirms the presence of anaerobic microbial com-

munities, which are more numerous in near-shore areas; (5) macrophyte species known to be bioaccumulators of heavy metals were found; (6) all sediment sampling stations produced toxic responses in single-species bioassays, with over half the stations classified as 'highly toxic'; and, (7) community-level bioassays showed toxic effects at 71% of the stations. (Lantz-PTT) W89-02870

NATIONAL ACID PRECIPITATION ASSESS-MENT PROGRAM: ANNUAL REPORT, 1986. National Acid Precipitation Assessment Program, Washington, DC. Office of the Director of Re-

searcn. Available from the National Technical Information Service, Springfield, VA 22161, as DE88-003900. Price codes: A06 in paper copy, A01 in microfiche. Report No. DOE/NBM-800, 1986. 164p, 25 fig, 9

Descriptors: *Air pollution effects, *Acid rain, *Path of pollutants, *Fate of pollutants, Finances, Research priorities, Air pollution, Chemical analysis, Air quality, Environmental effects, Legislation, Precipitation

In accordance with the Acid Precipitation Act of 1980 (PL 96-294), the Interagency Task Force on Acid Precipitation is pursuing a comprehensive research program. Federally funded acidic deposition research has expanded from about \$17 million in FY 1982 to the current (FY 1986) level of \$84 million. As is recognized in the Act, it will take a systematic effort across the duration of the 10-year recogning to adocustely eddress makes uncertainties. program to adequately address major uncertainties about the causes, effects and questions relating to about the causes, effects and questions relating to the management and mitigation of acidic deposi-tion. The 'Research Overview' section of the 1986 Annual Report provides a synopsis of the results of past and present NAPAP research activities and an past and present NAPAP research activities and an outline for future research efforts. This section is organized by the following task groups: Emissions and Controls; Atmospheric Chemistry; Atmospheric Transport; Atmospheric Deposition and Air Quality Monitoring; Terrestrial Effects; Aquatic Effects; Effects on Materials and Cultural Resources; and Mid-Term Findings. (Lantz-PTT) W89-02873

NAPAP OPERATING RESEARCH PLAN: 1986-1988.

1988, Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab. Available from the National Technical Information Service, Springfield, VA. 22161, as DE88-003901. Price codes: A18 in paper copy, A01 in microfiche. Report No. DOE/NBM-8003901, (1988). 436p, 2

Descriptors: *Research priorities, *Acid rain, *Water pollution sources, *National Acid Precipitation Assessment Program, Management planning, Monitoring, Decision making, Finances,

The goal of the National Acid Precipitation Assessment Program (NAPAP) is to develop and progressively refine an objective and comprehensive body of information on the causes and effects progressively retine an objective and comprehensive body of information on the causes and effects of acidic deposition. The program includes research, monitoring and assessment activities that emphasize the timely development of a firmer scientific basis for decision-making by legislators, regulatory officials, resource managers, environmental groups, and the public. The Office of the Director of Research, which is responsible for the day-to-day management of the National Program, has developed this NAPAP Operating Research Plan to describe each project, its objectives and scope, and its specific contributions to the integrated research effort. The Plan also includes overview sections on the research activities of each Task Group. This document is used by NAPAP management to plan and implement this comprehensive research effort. The information contained in the plan will guide NAPAP and its member agencies in refining research goals, proposing new initiatives, and developing the annual NAPAP interagency budget. Each Task Group chapter of the Operating Plan consists of several elements: a tex-

tual overview of the scope of the Task Group's research effort; a summary of major Task Group deliverables and their anticipated dates of completion; a tabular summary of all ongoing research projects and their funding; individual project descriptors outlining the performer(s), duration, funding history, objectives, work plan, and deliverables for each project. (Lantz-PTT) W89-02876

SUSPENDED SEDIMENT PROPERTIES AND THEIR GEOMORPHOLOGICAL SIGNIFI-

Exeter Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2J. W89-02899

LITERATURE STUDY ON THE FEASIBILITY OF MICROBIOLOGICAL DECONTAMINA-TION OF POLLUTED SOILS,

Hoofdgroep Maatschappelijke Technologie TNO, Delft (Netherlands).

For primary bibliographic entry see Field 5G. W89-02916

BIOLOGICAL TREATMENT OF TOXIC IN-DUSTRIAL WASTE,

National Environmental Engineering Research Inst., Nagpur (India). Environmental Microbiology

For primary bibliographic entry see Field 5D. W89-02919

SUPERFUND RECORD OF NORTHERN ENGRAVING, WI. OF DECISION:

NORTHERN ENGRATING, WI. Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-185731. Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA/ROD/R05-87/057, September 1987. 51p, 6 fig, 14 tab.

Descriptors: *Superfund, *Industrial wastewater, *Water pollution sources, *Water pollution treatment, *Metal-finishing wastes, *Path of pollutants, *Cleanup operations, Heavy metals, Costs, Sparta, Wisconsin, Aluminum, Cadmium, Copper, Nickel, Iron, Fluoride, Trichloroethylene.

The Northern Engraving Corporation (NEC), located in Sparta, Wisconsin, presently owns and operates a manufacturing facility at the site, which produces metal name plates, dials and decorative trim for the automotive industry. The majority of the land within the Sparta area is zoned for general agriculture which includes livestock raising, nursery, greenhouse and poultry farming. Four separate areas of contamination at the NEC facility have been identified as potential express of soil rate areas of contamination at the NEC facility have been identified as potential sources of soil, groundwater and surface water contamination. They include the sludge lagoon, seepagepit, sludge dumps site and lagoon drainage ditch. Rinse water from the plant was collected and treated with sodium hydroxide for precipitation to metal hydroxide soiled. The treated rinse water water the solid property of the contraction of the solid property of the solid proper droxide solids. The treated rinse water was dis-charged to the sludge lagoon to allow solids to settle. The treated lagoon effluent was discharged to the LaCrosse River by way of a storm drainage ditch. Between 1968 and 1976 the sludge lagoon ditch. Between 1968 and 1976 the sludge lagoon accumulated solids from the treated wastewater. An onsite seepage pit was employed to neutralize spent acid waste. It was removed from service, filled with approximately five feet of clean fill and graded in 1981. A new onsite above ground wastewater treatment system was installed in 1976 and modified in 1984 to meet more stringent State effluent standards. Approximately 900 cu yd of sludge is contaminated with phosphorus, aluminum, cadmium, copper, nickel, iron and fluoride. The drainage ditch is contaminated with fluoride, aluminum, chromium and copper: the seepage pit aluminum, chromium and copper; the seepage pit is contaminated with trichloroethylene (TCE); and groundwater is contaminated with copper, nickel and zinc. The selected remedial action for this site includes: excavation and onsite solidification of approximately 4,400 cu yd of sludge and soil; in-stallation of RCRA cover atop the lagoon; applica-

Group 5B-Sources Of Pollution

tion of access and deed restriction to the seepage pit property; and groundwater monitoring. The estimated total capital cost for this remedial action is \$295,000 with annual operation and maintenance costs of \$16,000. (Author's abstract)

FATE OF CRUDE OIL AT SEA AND THE NAT-URAL DISPERSION OF CRUDE OILS AND WATER-IN-OIL EMULSIONS: RESULTS OF EXPERIMENTS USING A LABORATORY TEST TANK AND FREE-FLOATING RINGS AT

Warren Spring Lab., Stevenage (England).

B. W. J. Lynch.

B. W. J. Lyncn.
Available from the National Technical Information Service, Springfield, VA 22161, as PB88-198726.
Price codes: E06 in paper copy, E06 in microfiche.
January 1987. 76p, 14 tab, 8 ref, 4 append.

Descriptors: *Oil, *Marine environment, *Fate of pollutants, *Emulsions, *Oil spills, Oil pollution, Dispersion, Water temperature.

The behavior of a number of crude oils has been examined to determine the factors affecting their subsequent dissipation from the surface when spilt at sea. The effect of parameters such as initial oil at sea. The effect of parameters such as initial oil film thickness, water temperature and asphaltene content of the parent crude oil upon emulsion formation and natural dispersion rates has been examined. The results obtained at sea have indicated that the rates of viscosity increase, due to emulsion formation, and the measured initial dispersion rates of the oils tested can be related to their asphaltene contents. Laboratory results have shown that over the range of water temperatures used, 5, 10 and 20 C, indications are that the lower water temperatures change of water to femulsion. water temperatures enhance the rate of emulsion formation and reduce the rate of initial dispersion by increasing the initial rate at which the viscosity rises during emulsion formation. (Author's abstract) W89-02944

DEVELOPMENT AND FIELD USE OF A SNOW COLLECTOR FOR ACID PRECIPITA-TION STUDIES,

TION STUDIES, Warren Spring Lab., Stevenage (England).
D. J. Hall, S. M. Cottrill, A. L. Goldsmith, S. L. Upton, and R. A. Waters.
Available from the National Technical Information Service, Springfield, VA 22161, as PB88-197934.
Price codes: E06 in paper copy, E06 in microfiche.
January 1988. 65p, 37 fig, 2 tab, 9 ref.

Descriptors: "Snow, "Acid rain, "Data acquisition, "Snow collectors, "Rain gages, Water pollution sources, Path of pollutants, Scotland, Sampling, Field tests, Chemistry of precipitation, Evaporation, Rain, Precipitation

A novel form of snow collection, based on sound A novel form of show collection, based on sound aerodynamic principles, can maintain a high collection efficiency in strong winds. The collector was intended for use in acid precipitation studies, where there are particular difficulties in obtaining complete, uncontaminated samples of snow precipitation suitable for analysis. A suitable design of the collector for field use was produced and nine collectors manufactured and used at six sites, analysis. Sectland diving the writer of 1085/86. mainly in Scotland, during the winter of 1985/86. The design proved to be an effective collector and generally worked well, the only significant fault being the loss by evaporation of a proportion of small precipitation samples. Sufficient good results were obtained to allow a tentative study of the differences between rain and snow precipitation chemistry. (Lantz-PTT)

WATER QUALITY ASSESSMENT OF DOD IN-STALLATIONS/FACILITIES IN THE CHESA-PEAKE BAY REGION. PHASE III REPORT. VOLUME 1 - SUMMARY.

Tetra Tech, Inc., Arlington, VA. For primary bibliographic entry see Field 5C. W89-02953 WATER QUALITY ASSESSMENT OF DOD IN-STALLATIONS/FACILITIES IN THE CHESA-PEAKE BAY REGION, PHASE III REPORT. VOLUME 2 - OVERALL APPROACH, FIND-INGS AND RECOMMENDATIONS.

Tetra Tech, Inc., Arlington, VA.
For primary bibliographic entry see Field 5C.
W89-02954

GASTROINTESTINAL ABSORPTION OF SOLUBLE URANIUM FROM DRINKING

WATER, Utah Univ., Salt Lake City. School of Medicine. M. E. Wrenn, N. P. Singh, H. Ruth, and D.

Burleigh.
Available from the National Technical Information Available from the National 1 echnical information Service, Springfield, VA 22161, as PB88-201231. Price codes: A02 in paper copy, A01 in microfiche. Report No. EPA/600/D-88/078, April 1988. 4p, 2 fig, 9 ref.

Descriptors: *Path of pollutants, *Drinking water, *Bioaccumulation, *Human physiology, *Uranium, Absorption, Fate of pollutants, Public health.

In 1983, a literature review published data on gastrointestinal [GI] absorption and distribution of uranium in the body. Estimates for the fraction of uranium absorbed by humans varied tenfold, from 0.8% to 8.0%, with a concensus 'best estimate' of 1.4%. The International Commission on Radiobiological Protection (ICRP) has recommended the logical Protection (ICRF) has recommended the use of 5% for the GI absorption of soluble uranium by occupationally-exposed workers. The GI absorption of uranium in man may be affected by other factors also. Other studies found that the onlier natures also. Other studies found that the absorption of uranium is three to seven times higher when given to rats on a fasting stomach than with food. (Lantz-PTT) W89-02957

U.S. PRODUCTION OF MANUFACTURED GASES: ASSESSMENT OF PAST DISPOSAL PRACTICES,

Research Triangle Inst., Research Triangle Park,

For primary bibliographic entry see Field 5E. W89-02964

CRITIQUE OF MODELS FOR FRESHWATER AND SOIL ACIDIFICATION,

AND SOIL ACIDIFICATION,
Senter for Industriforskinig, Oslo (Norway).
J. O. Reuss, N. Christophersen, and H. M. Selp.
Available from the National Technical Information
Service, Springfield, VA 22161, as DE88-751202.
Price codes: A03 in paper copy, A01 in microfiche.
Report No. 85 01 37 - 1, July 1986. Colorado
Agricultural Experiment Station Project 6232.

Descriptors: *Acid rain effects, *Acidification, *Soil contamination, *Model studies, *Water pollution sources, Hydrogen ion concentration, Chemical studies, Mathematical models, Aluminum.

Four types of models quantifying effects of acid deposition on freshwaters are reviewed. Emphasis is on an assessment of critical assumptions. The models range from simple to very complex and from empirical to highly process oriented. Empirical models are useful in systemizing large amounts of information and have led to a focus on important concepts. By using basic soil chemistry and quantifying key parameters essential insight as well as new ideas for experimental studies were obtained. At their present stage, the models indicate that, under some conditions, acid deposition may have a strong effect on fresh water chemistry, particularly pH and aluminum concentration. The results have further clarified the role of other factors such as forest growth in contributing to water acidification. (Lantz-PTT) deposition on freshwaters are reviewed. Emphasis

ROCKY MOUNTAIN ACID DEPOSITION MODEL ASSESSMENT: EVALUATION OF MESOSCALE ACID DEPOSITION MODELS FOR USE IN COMPLEX TERRAIN, Systems Applications, Inc., San Rafael, CA. R. E. Morris, R. C. Kessler, S. G. Douglas, and K.

R. Styles

Available from the National Technical Information Available from the National Technical Information Service, Springfield, VA 22161, as PB88-167481. Price codes: A10 in paper copy, A01 in microfiche. Report No. EPA/600/3-88/008, February 1988. 227p, 58 fig, 4 tab, 72 ref, append. EPA Contract No. 68-02-4187.

Descriptors: *Path of pollutants, *Acid rain, *Meteorology, *Rocky mountains, *Model studies, Water pollution sources, Mountains, Wind, Air pollution, Chemical analysis, Computer models.

The hybrid acid deposition/air quality modeling system for the Rocky Mountains makes use of a mesoscale meteorological model, which includes a new diagnostic wind model, as a driver for a Lagrangian puff model that treats transport, dispersion, chemical transformation, and dry and wet deposition. Transport will be defined from the diagnostic wind model based on the wind at the puff center. The treatment of dispersion will be based on the parameterization in the PNL/MELSAR-POLUT, while retraining the MESO-PUFF-II dispersion algorithms as an option. Based on the evaluation of the chemical mechanisms, the RIVAD chemistry appears to be the most scientifion the evaluation of the chemical mechanisms, the RIVAD chemistry appears to be the most scientifically sound, as well as consistent, with the Lagrangian puff model formulation. Dry deposition will use the CCADM dry deposition module with some minor adjustments. Wet deposition will be based on the scavenging coefficient approach as used in the ERT/MESOPUFF-II. (Author's abstract)

NEARSHORE TRANSPORT PROCESSES AF-FECTING THE DILUTION AND FATE OF ENERGY-RELATED CONTAMINANTS, Skidaway Inst. of Oceanography, Savannah, GA.

Available from the National Technical Information Service, Springfield, VA 22161, as DE88-004808. Price codes: A03 in paper copy, A01 in microfiche. Report No. DOE/ER/60351-3, December 1, 1987. 26p, 7 fig, 4 tab. DOE Contract DE-FG09-85ER60351.

Descriptors: *Electric power production, *Thermal pollution, *Fate of pollutants, *Path of pollutants, *Nearshore processes, Literature review, Oceanography.

Progress is reported for a 3-year period between January 1985 to December 1987 for a DOE regional program of Coastal Oceanography in the south-eastern U.S., hereafter called the South Atlantic Bight (SAB). Research has encompassed a combination of theoretical and experimental work in order to understand the role of coastal fronts and associated circulation processes in transporting ma-terial on the continental shelf of the SAB. A major effort was to study the formation and dissipation of fronts such as mid-shelf fronts found in the winter in the SAB and the coastal front formed by estua-rine inputs off South Carolina and Georiga, and frictional response of currents on the continental shelf and the response of shelf currents on the 'remote' disturbances of storms and the Gulf Stream. While the inner shelf frontal zone off Georgia and South Carolina inhibits the transfer of materials offshore, there are processes that can break down this inhibition. Simulations are deorized down this initiotion. Similations are up-scribed which show that southward wind stress events can spread the front seaward and detach lenses of surface water and advect them seaward and out of the coastal boundary zone (CBZ). This represents an important mechanism by which con-taminants in the surface are removed from th inner shelf. However, it material has settled to the bottom, this 'upwelling' circulation inhibits the ad-vection of material out of the CBZ and it is vection of material out of the CB2 and it is thought to be trapped there. Since autumn and winter seasons are characterized by prediminantly downdwelling favorable wind stress, the circula-tion described above is reversed in an average sense. The frontal zone becomes relatively narrow (extends 5-10 km offshore) providing a significantly reduced volume fo rthe dilution of contami-nants. Experimental studies of riverine plumes in autumn support theoretical studies that the winds play a dominant role in governing whether con-

Sources Of Pollution—Group 5B

taminants in river plumes affect adjacent shorelines or not. During upwelling favorable winds, the plumes extend directly offshore where they rapidly mix with shelf water. If winds are downwelling favorable, plumes are bent alongshore and downwind where they can essentially bathe the shore environment. (Lantz-PTT) W89-02972

EVALUATION OF BASELINE CONDITIONS AT LEASE TRACT C-A, RIO BLANCO COUNTY, COLORADO, University of Wyoming Research Corp., Laramie. Western Research Inst. W. L. Barteaux, and G. Biezugbe. Available from the National Technical Information Service, Springfield, VA 22161, as DE88-004169. Price codes: A03 in paper copy, A01 in microfiche. Report No. DOE/MC/11076-2442, September 1987. 46p, 9 fig. 9 tab, 16 ref, 2 append. DOE Contract No. DE-FC21-86MC11076.

Descriptors: *Baseline studies, *Colorado, *Oil industry, *Groundwater quality, *Water quality, *Oil shale, Rio Blanco County, Aquifers, Standards, Monitoring.

An analysis was made of baseline groundwater quality data from oil shale lease tract C-a, managed by Rio Blanco Oil Shale Company, Baseline conditions were determined by analyzing data from wells in the upper bedrock and lower bedrock aquifers and from the alluvial wells. Baseline data aquiters and from the alluvial wells. Baseline data were considered to be all data collected before mining operations began. The water quality was evaluated using the 1987 Colorado State Basic Standards for Ground Water as a basis. The baseline water quality in all three aquifers does not meet Colorado water quality standards. The maximum baseline values exceed the standard values for mum baseline values exceed the standard values for several parameters in each aquifer. The quality of the upper and lower bedrock aquifers varies from region to region within the site. Concentrations of some parameters are significantly higher in the northeast and southwest regions of the lower bedrock aquifer, and in the northeast region of the upper bedrock aquifer. Variations in the upper bedrock aquifer are possibly caused by leakage of the lower bedrock aquifer. (Lantz-PTT) W89-02974

PILOT SCALE EVALUATION OF SLUDGE LANDFILLING: FOUR YEARS OF OPER-

SCS Engineers, Inc., Covington, KY. For primary bibliographic entry see Field 5E. W89-02978

SUPERFUND RECORD OF DECISION: KA-TONAH MUNICIPAL WELL, NY. Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response. For primary bibliographic entry see Field 5G. W89-02979

SUPERFUND RECORD OF DECISION: INDE-PENDENT NAIL, SC. Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response. For primary bibliographic entry see Field 5G. W89-02980

SUPERFUND RECORD OF DECISION: ENDI-COTT WELL FIELD, NY.

Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response. For primary bibliographic entry see Field 3G. W89-02983

GROUNDWATER ASSESSMENT MODELING UNDER THE RESOURCE CONSERVATION AND RECOVERY ACT, Battelle Pacific Northwest Labs., Richland, WA. G. Whelan, S. M. Brown, D. L. Strenge, A. P. Schwab, and P. I. Mitchell. Available from the National Technical Information Service, Springfield, VA 22161, as DE88-005287.

Price codes: A10 in paper copy, A01 in microfiche. Report No. EPRI-EA-5342, January 1988. Final Report. 235p, 46 fig, 15 tab, 444 ref, 3 append. EPRI Research Project 2070-1.

Descriptors: *Fate of pollutants, *Mathematical models, *Path of pollutants, *Industrial wastes, *Groundwater pollution, *Electric power indus-try, Risk assessment, Public health, Selenium, Waste disposal, Water sampling, Mathematical

A methodology is being developed for the Electric Power Research Institute (EPRI) that will provide Power Research Institute (EPRI) that will provide the electric utility industry with a means of quanti-fying health risks posed by the disposal of utility wastes (e.g., fly ash and bottom ash). The method is oriented toward quantitative analyses and uses mathematical modeling techniques to address the various environmental pathways through which a contaminant can migrate. Typical features that groundwater and exposure analysis codes should possess for use in a risk analysis are identified. By assessing typical mathematical codes that analyze contaminant transport in groundwater systems contaminant transport in groundwater systems (i.e., partially saturated and saturated zones) and (i.e., partually saturated and saturated zones) and human exposure, a basis is provided that risk ana-lysts can use to choose components of the assess-ment framework. Two levels of modeling sophisti-cation are also identified: Level I (preliminary screening codes with minimal data requirements) and Level II (detailed mathematical codes with extensive data requirements) codes. The methodology as applied to a test case to demonstrate its implementation and use. This test case highlights the migration and fate through the groundwater system of selenium from a waste disposal facility for a coal-fired power plant. Level I and Level II tor a coat-meter power piant. Ever I and Ever I massessments are compared for several conditions that might exist at the site. The comparison illustrates the differences between the level of effort required and the resolution of results for Level I and Level II assessments. Also presented is an example Level I, screening level analysis of arsenic example Level 1, screening level analysis of arsenic releases to the groundwater system at a hypotheti-cal coal-fired power plant located in an arid region of the Pacific Northwest. This analysis is designed to complement an earlier, more detailed risk assess-ment of arsenic emissions to surface waters. W89_02995

ACID PRECIPITATION IN NORTH AMERICA: 1985 ANNUAL AND SEASONAL DATA SUM-MARIES FROM ACID DEPOSITION SYSTEM DATA BASE

Environmental Monitoring Systems Lab., Re-search Triangle Park, NC.

search Triangle Park, NC.
J. K. Sweeney, and A. R. Olsen.
Available from the National Technical Information
Service, Springfield, VA 22161, as PB88-166897.
Price codes: A18 in paper copy, A01 in microfiche.
Report No. EPA 600/4-87/035, November 1987.
451p, 1 fig, 7 tab 24 ref, 4 append.

Descriptors: *Acid rain, *North America, *Data collections, *Data interpretation, *Water pollution sources, Databases, Surveys, Networks, Hydrogen ion concentration, Conductivity, Calcium, Chlorides, Sodium, Magnesium, Potassium, Maps, Sul-

Wet deposition precipitation chemistry data collected in 1985 in North America is available in the Acid Deposition System (ADS) data base. North America wet deposition monitoring networks with data in ADS are NADP/NTN, CANSAP, APN, UAPSP, MAP3S/PCN, WISC, and APIOS. An overview of each network is given. Annual statistical summaries for 1985 are provided for pH, specific conductance, hydrogen ion (derived from pH), and the ion species sulfate, nitrate, ammonium, calcium, chloride, sodium, magnesium and potassium. Based on the annual summaries, 1985 North American spatial isopleth maps are constructed for precipitation weighted mean pH, sulfate, nitrate, and ammonium ion concentrations, and annual deposition of hydrogen, sulfate and nitrate and ammonium ion species. (Author's abstract) W89-02997 w89-02997

INSTALLATION RESTORATION PROGRAM PHASE II - CONFIRMATION/QUANTIFICATION, STAGE I.

Radian Corp., Austin, TX.

Available from the National Technical Information Service, Springfield, VA 22161, as AD-A191 018. Price codes: A06 in paper copy, A01 in microfice, Final Report, March 1984-August 1986, April 1987. Volume 1. 133p, 30 fig, 24 tab. USAF Con-tract F33615-83-D-4001.

Descriptors: *Path of pollutants, *Waste disposal, *Water pollution treatment, *Military installations, Cleanup, Fate of pollutants, Groundwater pollution, Soil contamination, Lead, Benzene, Drinking

The Department of Defense's Installation Restoration Program (IRP) is a four-phase program to identify past waste disposal practices, evaluate environmental impacts, propose mitigation measures, and remediate environmental problems. Phase I of the IRP is an initial assessment and records search to locate potential environmental problems associated with waste disposal practices. The Phase II I field study was conducted between March 1984 and August 1986. The investigation focused on whether environmental contamination had occurred, the magnitude and extent of the contamination, and the environmental consequences of miton, and the environmental consequences of mitons. tion, and the environmental consequences of mi-grating pollutants. Nine boreholes were drilled, installed, and sampled. Contaminants were detect-ed in the soil and groundwater at most of the sites. di nite soil and groundwater at most of the sites. In some cases, inorganic compounds in the groundwater exceeded regulatory standards. The contaminants detected in the highest quantities in the groundwater were lead and benzene. However, the shallow groundwater at the base is not used for drinking water. Shallow groundwater use outside the base is unknown, but it is not believed to include drinking water supplies. Additionally, the existing aquifers are thin and discontinuous on the base so that no known immediate threat to human health exists. Each of the eleven sites was categorized according to Air Force criteria: Category II additional work needed, or Category III - institute remedial action. All sites were category II. (Lantz-PTT) W89-02999

QUANTITY AND QUALITY OF STORM RUNOFF FROM THREE URBAN CATCH-MENTS IN BELLEVUE, WASHINGTON, Geological Survey, Tacoma, WA. Water Re-

sources Div. E. A. Prych, and J. C. Ebbert.

Available from Books and Open File Report Section, USGS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4000, 1986. 85p, 14 fig. 34 tab, 17 ref, 3 plates in pocket.

Descriptors: *Storm runoff, *Urban runoff, *Water pollution sources, *Detention reservoirs, *Belle-vue, *Washington, Flood peak, Runoff volume, Nitrogen, Regression analysis, Urban watersheds, Runoff, Urban hydrology.

Data on the quantity and quality of urban runoff were collected, analyzed, and used to evaluate the effects of street sweeping and of stormwater detention on quality of runoff. The data included rainfall, runoff discharge, concentrations of selected constituents in discrete samples of runoff, and chemical characteristics of wet- and dry atmospheric deposition. Statistical analyses of runoff loads and of discharge-weighted constituent concentrations in runoff for about 25 different storms showed that, for most constituents, street sweeping had little effect on water quality. One reason is that showed that, for most constituents, street sweeping had little effect on water quality. One reason is that much of the suspended material in runoff consisted of silt- and clay-size particles, the size classes least affected by street sweeping. That data also show that rainfall is often the source of one-third of the total nitrogen in stormwater runoff. Comparison of discharge-weighted average concentrations of the inflow and outflow of a stormwater detention system for four to seven storms indicated that the detention system did not have a large effect on the average concentrations of constituents in runoff. Regression equations for predicting runoff volumes

Group 5B-Sources Of Pollution

and peak discharges for individual storms were derived separately for each catchment using data from nearly all storms. Standard errors of estimate for these storms were 21-28% for runoff volume and 22-40% for peak discharge. (Peters-PTT)

RESULTS OF EXPERIMENTS RELATED TO CONTACT OF MINE-SPOILS WATER WITH COAL, WEST DECKER AND BIG SKY MINES, SOUTHEASTERN MONTANA, Geological Survey, Helena, MT. Water Resources This.

Div.

R. E. Davis, and K. A. Dodge.

Available from Books and Open File Report Section, USGS, Box 25425, Deaver, CO 80225. USGS Water-Resources Investigations Report 86-4002, April 1986. 16p, 1 fig, 5 tab, 4 ref.

Descriptors: *Water pollution sources, *Leaching, *Groundwater pollution, *Mine water, *Coal mining, *Coal aquifers, *Montana, Water quality, Water chemistry, Metals, Minerals, Aquifers.

Batch-mixing experiments using spoils water and coal from the West Decker and Big Sky Mines were conducted to determine possible chemical changes in water moving from coal-mine spoils through a coal aquifer. The spoils water was combined with air-dried and oven-dried chunks of coal bined with air-arried and oven-arried chunks of colar and air-dried and oven-dried crushed coal at a 1:1 weight ratio, mixed for 2 hr, and separated after a total contact time of 24 hr. The dissolved-solids concentration in water used in the experiments decreased an average 210 mg/liter (5-10%). Other chemical changes included general decreases in the cnemical changes included general decreases in the concentrations of magnesium, potassium, and bi-carbonate, and general increases in the concentra-tions of barium and boron. The magnitude of the changes increased as the surface area of the coal increased. The quantity of extractable cations and exchangeable cations on the post-mixing coal was larger than on the pre-mixing coal. Equilibrium and mass-transfer relations indicate that adsorption and mass-transfer relations indicate that adsorption reactions or ion-exchange and precipitation reac-tions, or both, probably are the major reactions responsible for the chemical changes observed in the experiments. (Authors' abstract) W89-03001

MATHEMATICAL MODELS FOR INTERPRE-TATION OF TRACER DATA IN GROUND-WATER HYDROLOGY.

International Atomic Energy Agency, Vienna For primary bibliographic entry see Field 2F. W89-03009

APPLICATION OF A TRANSPORT-DIFFU-SION MODEL TO A COASTAL AQUIFER UTI-LIZING IN SITU MEASUREMENTS OF DIS-

For primary bibliographic entry see Field 2F. W89-03016

RUNOFF CHARACTERISTICS AND WASHOFF LOADS FROM RAINFALL-SIMULA-TION EXPERIMENTS ON A STREET SUR-FACE AND A NATIVE PASTURE IN THE DENVER METROPOLITAN AREA, COLORA-

DO, Geological Survey, Arvada, CO. For primary bibliographic entry see Field 2E. W89-03036

MIGRATION OF ACIDIC GROUNDWATER SEEPAGE FROM URANIUM-TAILINGS IM-POUNDMENTS: I, FIELD STUDY AND CON-CEPTUAL HYDROGEOCHEMICAL MODEL, Morwijk Enterprises, Vancouver (British Colum

bia). K. A. Morin, J. A. Cherry, N. K. Dave, T. P. Lim,

R. A. Morin, J. A. Cherry, N. K. Dave, T. P. Lim, and A. J. Vivyurka. Contaminant Hydrology JCOHE6, Vol. 2, No. 4, p 271-303, August 1988. 15 fig, 1 tab, 35 ref. National Science and Engineering Research Council (Canada) Grant G0679.

Descriptors: *Mine drainage *Acid mine water, *Groundwater pollution, *Path of pollutants, *Uranium, *Plumes, *Model studies, Geochemistry, Neutrilization, Glacial aquifers, Aquifer management, Chemical properties, Sulfates, Iron, Aluminum, Hyrdogen ion concentration, Seepage.

Results of a study at a non-operational uranium tailings site are used to construct a general conceptual model for seepage migration from uranium-tailings impoundments. Many parts of the model are applicable to other types of tailings and to acid drainage in general. At the field site, the impoundment lies over a portion of a glaciofluvial sand aquifer. Tailings seepage drains downward into the aquifer and then migrates laterally away. Results of the field study indicate the seepage can be divided into three geochemical zones: (1) the inner core, which is essentially unaltered, acidic seepage from the tailings: (2) the neutralization zone, in which which is essentially unaltered, acidic seepage from the tailings; (2) the neutralization zone, in which inner-core water is neutralized and aqueous concentrations decrease significantly; and (3) the outer zone, which contains both neutralized water from the neutralization zone and pH-neutral process water from the uranium milling operation. Yearly comparisons from 1979 to 1984 indicate the neutralization zone and inner core are migrating downgradient at a rate of 1 m/y, which is about 1/440 of the groundwater velocity. The mechanisms that produce the retardation and the decreases in that produce the retardation and the decreases in aqueous concentrations are part of the conceptual model, which has as its main features solid-liquid interactions, particularly mineral precipitation-dis-solution, and buffering effects of dominant aqueous species. The important minerals undergoing precipitation-dissolution are the calcite-siderite solid solution, gypsum, Al-OH minerals, and Fe-OH minerals. 'Cell and streamtube' calculations are used to evaluate the general trends in aqueous concentrations and to assist in explaining observed concentrations and to assist in explaning observed migration rates. Co-precipitation with the above minerals apparently accounts for decreases in the other major, minor, and metal solutes. (See W89-03038 through W89-03039) (Author's abstract) W89-03037

MIGRATION OF ACIDIC GROUNDWATER SEEPAGE FROM URANIUM-TAILINGS IM-POUNDMENTS: 2. GEOCHEMICAL BEHAV-IOR OF RADIONUCLIDES IN GROUNDWAT-

Morwijk Enterprises, Vancouver (British Columbia). K. A. Morin, J. A. Cherry, N. K. Dave, T. P. Lim,

A. A. Morin, J. A. Cherry, N. K. Dave, T. P. Lim, and A. J. Vivyurka. Contaminant Hydrology JCOHE6, Vol. 2, No. 4, p 305-322, August 1988. 4 fig, 4 tab, 16 ref. National Science and Engineering Research Council (Canada) Strategic Grant GO679.

Descriptors: *Acid mine water, *Groundwater pollution, *Path of pollutants, *Uranium, *Plumes, *Model studies, *Radioisotopes, *Geochemistry, Neutrilization, Glacial aquifers, Computer programs, Aquifer management, Seepage, Speciation.

In the second paper of a series on groundwater In the second paper of a series on groundwater seepage from uranium tailings, the general geochemical behavior of radionuclides is described and then applied to data from the field site, Seepage Area A of the Nordic Main impoundment near Elliot Lake, Ontario. The delineation of radionuclide behavior requires (1) the calculation of total element concentration by the summation of consertations of the second concentrations of the second concentrations of the second concentrations. centrations of each element's isotopes (the isotopic concentrations are calculated from the isotope's radioactivities), (2) the evaluation of solid-liquid interactions using total element concentrations, and (3) for particular isotopes, the evaluation of the extent to which parental geochemical behavior causes a deviation in the isotope's behavior from that of its total element. A computerized speciation program, WATRAD, is used to evaluate aqueous program, WATKAD, is used to evaluate aqueous complexation and mineral saturation indices of radium, actinium, thorium, and uranium. Data from Seepage Area A on isotopes of these four elements plus Pb(210) show that the geochemical behavior of radionuclides can be best defined on an individual isotopic basis rather than on an elemental basis. (See also W89-03037 and W89-03039) (Author's betterat). (Author's abstract) W89-03038

MIGRATION OF ACIDIC GROUNDWATER SEEPAGE FROM URANIUM-TAILINGS IM-POUNDMENTS: 3, SIMULATIONS OF THE CONCEPTUAL MODEL WITH APPLICATION TO SEEPAGE AREA A,
Morwijk Enterprises, Vancouver (British Colum-

bia).
K. A. Morin, and J. A. Cherry.
Contaminant Hydrology JCOHE6, Vol. 2, No. 4, p
323-342, August 1988. 4 fig., 5 tab, 24 ref. National
Science and Engineering Research Council
(Canada) Strategic Grant GO679.

Descriptors: *Acid mine water, *Groundwater pollution, *Path of pollutants, *Uranium, *Plumes, *Model studies, *Geochemistry, Cost analysis, Feasibility studies, Computer programs, Neutralization, Glacial aquifers, Aquifer management, Model studies, Seepage.

In the third paper of a series the conceptual model In the third paper of a series the conceptual model for contaminant migration is coded into a family of computer programs named ADNEUT. Simulations with ADNEUT show that the neutralization zone is composed of a sequence of several sub-regions through which a theoretical step-function increase in pH and change in other aqueous constituents occur from the inner core to the outer zone. The pH, aqueous chemistry, and retardation of each sub-region are the result of the dissolution of, and buffering by, one of the minerals of the conceptual model. The behavior of a sub-region affects the behavior of all downgradient sub-regions, resulting behavior of all downgradient sub-regions, resulting in a complex scenario of dependence for sub-re-gions at a site. Depending on the information re-quired from a simulation, ADNEUT can be used in its one-cell, two-cell or multi-cell mode. The use of ADNEUT in its one-cell mode demonstrates the ADNEUT in its one-cell mode demonstrates the limitations of laboratory batch tests, titration tests, and non-transport geochemical programs in evaluating contaminant migration. ADNEUT is calibrated to current conditions at Seepage Area A at the Nordic Main impoundment in order to demonstrate the applicability of the conceptual model, to show specific limitations of the model, and to illustrate the measured data required for a reliable simulation. Edlowing calibration. ADNEUT is illustrate the measured data required for a rename simulation. Following calibration, ADNEUT is used to examine probable past behavior of the contaminant plume prior to monitoring. The plume was likely more acidic in the past, apparently originates very close to or within the waste-rock impoundment dam, and began migrating out of the source area in 1966-67. ADNEUT is then used to examine possible future behavior of the plume under the assumptions of continuation of current conditions, decreasing acidity, and increasing acidity through time. (See W89-03037 thru W89-03038) (Author's abstract)

INFLUENCE OF COSOLVENTS ON QUINO-LINE SORPTION BY SUBSURFACE MATERI-ALS AND CLAYS.

Battelle Pacific Northwest Labs., Richland, WA. J. M. Zachara, C. C. Ainsworth, R. L. Schmidt, and C. T. Resch.

Contaminant Hydrology JCOHE6, Vol. 2, No. 4, p 343-364, August 1988. 10 fig, 4 tab, 39 ref. U.S. DOE Contract DE-AC06-76RLO 1830.

Descriptors: *Path of pollutation, *Sorption, *Groundwater pollution, *Chemical wastes, *Clay, Percolation, Solutes, Solvents, Chemical properties, Ion exchange, Physicochemical properties, Thermodynamics, Subsurface water.

Quinoline sorption was measured on Na-saturated subsurface materials, a natural clay isolate, and montmorillonite, and was dominated by exchange of the quinolinium ion. In water/methanol and water/acetone mixtures, quinoline sorption on the subsoils and clays was lower than from water. In cosolvent, sorption followed the ionization fraction cosolvent, sorption followed the ionization fraction indicating the continued predominance of ion exchange. The reduction in quinoline sorption by cosolvent was similar for all the subsoils and clays indicating commonality in the surface-solute-solvent interaction. Conditional equilibrium constants for quinoline exchange on the subsoils in water/methanol mixtures decreased log-linearly with mole percent cosolvent up to 20% methanol. This

Sources Of Pollution—Group 5B

decrease closely followed the increase in quinoline solubility in the cosolvent mixtures. Acetone caused greater reduction in sorption than methanol, at comparable mole percent, in accordance with its lower dielectric constant and enhanced solvating power. A generalized thermodynamic approach based on the concept of transfer activity coefficients was developed to account for the cosolvent effect on the conditional equilibrium constants and was successfully applied to the quinoline sorption data. The thermodynamic analysis suggested that enhanced solvation of the organic cation in the bulk solvent and desolvation of Na(+) at the charge surface predominate the cosolvent effect. (Author's abstract) decrease closely followed the increase in quinoline

INVESTIGATIONS ON LEACHING OF DI-CYANDIAMIDE AND ITS DECOMPOSITION IN FLOODED SOILS (UNTERSUCHUNGEN ZUR AUSWASCHUNG VON DICYANDIAMID UND DESSEN ABBAU IN UBERSTAUTEN

UND DESSEN ABBAU IN UBERSTAUTEN BODEN),
Technische Univ. Muenchen, Freising (Germany, F.R.). Lehrstuhl fuer Pflanzenernahrung.
V. A. Amberger, and K. Vilsmeier.
Zeitschrift fuer Wasser - und Abwasser Forschung ZWAGAQ, Vol. 21, No. 4, p 14-144, August 1988.
7 tab, 26 ref.

Descriptors: *Leaching, *Percolation, *Ground-water pollution, *Fertilizers, *Path of pollutants, Agricultural hydrology, Slurries, Manure, Flood irrigation.

Leaching of the nitrification inhibitor dicyandia-mide (DCD) was studied in lysimeters after fertilizing, slurry manuring, and decomposition of DCD under simulated groundwater conditions (silty loam, pH 6.5). After application, only 0.6-0.9% of DCD applied in 5 yr was leached. Highest leaching rates of DCD occurred after slurry application in October (5.6% of added amount). In sediments flooded with water to a height of 10 to 60 cm, dicyandiamide (20 mg/l) was fully degraded within 1 year in almost all experiments with aerobic conditions while with anaerobic conditions two-thirds was decomposed. (Author's abstract) W89-03043

EFFECTS OF OZONE AND ACID RAIN ON WHITE PINE (PINUS STROBUS) SEEDLINGS GROWN IN FIVE SOILS: II, MYCORRHIZAL

Cornell Univ., Ithaca, NY. Dept. of Agronomy. For primary bibliographic entry see Field 5C. W89-03057

EFFECTS OF OZONE AND ACID RAIN ON WHITE PINE (PINUS STROBUS) SEEDLINGS GROWN IN FIVE SOILS: III. NUTRIENT RE-

Boyce Thompson Inst. for Plant Research, Ithaca, NY.

For primary bibliographic entry see Field 5C. W89-03058

TEMPORAL RELATIONSHIP OF VIBRIO PARAHAEMOLYTICUS IN PATIENTS AND THE ENVIRONMENT, Shaughnessy Hospital, Vancouver (British Columbia). Div. of Microbiology. M. T. Kelly, and E. M. D. Stroh. Journal of Clinical Microbiology JCMIDW, Vol. 26, No. 9, p 1754-1756, September 1988. 1 fig, 2 tab, 7 ref.

Descriptors: *Human diseases, *Pathogenic bacteria, *Infection, *Vibrio, *Estuarine environment, Seasonal variation, Water temperature, Salinity, Pacific Northwest, Public health.

The occurrence of Vibrio parahaemolyticus in patients and the environment in the Pacific Northwest was compared. Inpatient and outpatient stool and wound specimens and water samples from 10 estuarine sites were cultured for V. parahaemolyticus over a period of 3 years. V. parahaemolyticus infections were detected in 13 patients (8 with

gastroenteritis; 5 with wound infections), and all of the infections were found in outpatients in physi-cians' offices. Ten of the infections were locally acquired, and three occurred in patients returning from tropical travel. V. parahaemolyticus was iso-lated from 11-33% of the environmental samples, lated from 11-33% of the environmental samples, and each sampling site yielded the organism at some time during the study. V. parahaemolyticus was found in the environment only during the summer months, when water temperatures were > or = 17 C and salinities were < or = 13 parts per thousand, and locally acquired infections were detected only when the organism was present in large numbers in the environment. It is concluded that V. parahaemolyticus causes locally acquired gastroenteritis and wound infections, as well as traveler's diarrhea, in the Pacific Northwest, that patients are likely to be seen in physicians' offices traveier's charrhea, in the Pacific Northwest, that patients are likely to be seen in physicians' offices rather than hospitals, that locally acquired V. parahaemolyticus infections occur only when the organism is present in the environment, and that the organism is likely to be present during the summer months, when warm, low-salinity water conditions prevail in the coastal marine environment. (Author's abstract) W89-03064

ENGINEERING, MOSQUITOES AND FILARI-ASIS: A CASE REPORT, London School of Hygiene and Tropical Medicine (England). Dept. of Tropical Hygiene. For primary bibliographic entry see Field 5G. W89-03065. For primary W89-03065

SCHISTOSOMIASIS CONTROL IN IRRIGA-TION SCHEMES IN ZIMBABWE, Hydraulics Research Ltd., Wallingford (England). For primary bibliographic entry see Field 5G. W89-03066

EXTRACTION, CLEAN-UP AND GROUP SEP-ARATION TECHNIQUES IN ORGANOCH-LORINE TRACE ANALYSIS,

Marine Lab., Aberdeen (Scotland).
For primary bibliographic entry see Field 5A.
W89-03068

GROUNDWATER MICROBIOLOGY: PROB-LEMS AND BIOLOGICAL TREATMENT: STATE-OF-THE-ART REPORT,

Vizgazdalkodasi Tudomanyos Kutato Intezet, Bu-dapest (Hungary). For primary bibliographic entry see Field 2F. W89-03075

ATMOSPHERIC, GEOLOGICAL, MARINE, AND ANTHROPOGENIC EFFECTS ON GROUNDWATER QUALITY IN FINLAND, Geologian Tutkimuskeskus, Espoo (Finland). Dept. of Geochemistry. P. W. Lahermo.

Water Science and Technology WSTED4, Vol. 20, No. 3, p 33-39, 1988. 3 fig, 8 ref.

Descriptors: *Finland, *Acid rain effects, *Geochemistry, *Water pollution sources, *Groundwater, *Water quality, *Groundwater pollution, Path of pollutants, Sulfates, Nitrates, Chlorides, Sodium, Calcium, Potassium, Brackish water, Saline water, Seawater, Atmosphere, Precipitation, Confined aquifers, Bedrock, Clay, Wells, Impaired water quality.

The atmospheric, geological, marine and anthropo-genic factors effecting the chemical quality of groundwater were evaluated. Sulfates and nitrates derive mainly from the atmosphere as wet or dry deposition in weakly mineralized shallow ground-water in natural uncontaminated surficial aquifers. The texture, structure and lithologic composition of aquifer material have an impact on water chemof aquiter material have an impact on water chemistry although marine influence and anthropogenic pollution generally outweigh the geological influence. Relict seawater trapped in deeper parts of confined aquifers and in bedrock covered by clay deposits has a marked effect on the quality of groundwater drawn from wells drilled into bedrock in the broad coastal belt. Brackish or saline

groundwater is encountered all over the country in holes drilled in crystalline bedrock to a depth of more than 500-1000 m. The lithologic environment affects the quality of deep bedrock groundwater which tends to change from Na-Cl type towards Ca-Na-Cl type with increasing salinity and depth of occurrence. Anthropogenic pollution is reflected in elevated amounts of all major dissolved components, although the most sensitive indicators of contamination are nitrates, chlorides and potassium. Nationwide hydrogeochemical mapping of rural water sources revealed that shallow wells dug into glacial till deposits had the highest median nitrate contents, and that spring water discharging from glaciofluvial sand deposits had the lowest. The quality of groundwater distributed by public waterworks is generally good. (Author's abstract) W89-03076 waterworks W89-03076

VULNERABILITY STUDY OF THE AUBER-

GENVILLE AQUIFER, Lyonnaise des Eaux, Paris (France). V. Retrowski, P. Alla, P. Suzanne, and D. d'Arras. Water Science and Technology WSTED4, Vol. 20, No. 3, p 41-46, 1988. 5 fig.

Descriptors: *Geohyrdology, *Groundwater movement, *Model studies, *Aquifers, *Ground-water pollution, *Groundwater recharge, *Catch-ment areas, *Artificial recharge, *Hydrodynamics, Mathematical models, Simulation, Aubergenville

The use of sophisticated underground flow simulation techniques with hydrodynamic and hydrodispersive mathematical models combined with a thorough knowledge of the local hydrogeological conditions and the regular collection of water extraction data are a sufficiently precise means to define the problem posed by pollution in a given catchment area. In France, the Lyonnaise des Eaux has for the past 20 years been operating a series of wells sunk in the upper-chalk Senonian stratum aquifer at Aubergeaville downstream from Paris on the left bank of the Seine. In 1976, Lyonnaise des Eaux undertook a series of studies connaise des Eaux undertook a series of studies connaise des Eaux undertook a series of studies constratum aquifer at Aubergenville downstream from Paris on the left bank of the Seine. In 1976, Lyonnaise des Eaux undertook a series of studies concerning the mathematical modelling of the aquifer in collaboration with the Seine River Basin Authority. THe first model was produced in 1976 for steady state flow. It had 475 meshes of different sizes ranging between 2500 and 625 m. After checking its correct adjustment, the catchment area model was made more discrete by dividing into a finer mesh of 300 m so as to aford greater precision in calculations. For example, the effects of 20 tonnes of polluting matter being poured onto the ground at the place called Le Profil were simulated. The pollution did not go any further than the first line of wells, which of course should not be stopped. They should, however, be equipped with some means to dispose of the polluted water. It will take some 5 months to remove this pollution. While potential dangers do exist, there are ways of solving the problem. The projection of certain critical situations made possible with these models places the operator in a position to deal appropriately with the situation in the event of a pollution incident. (Sand-PTT) W89-03077

INVESTIGATION INTO MECHANISMS OF MICROBIAL EFFECTS ON IRON AND MAN-GANESE TRANSFORMATIONS IN ARTIFI-CIALLY RECHARGED GROUNDWATER,

Zhengding Inst. of Hydrogeology and Engineering Geology (China). For primary bibliographic entry see Field 4B. W89-03078

MICROBIAL ACTIVITY IN SANITARY LAND-FILLS: A POSSIBLE SOURCE OF THE HUMIC SUBSTANCES IN GROUNDWATER,

Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene. Z. Filip, and R. Smed-Hildmann.

Water Science and Technology WSTED4, Vol. 20, No. 3, p 55-59, 1988. 2 fig, 2 tab, 16 ref.

Group 5B-Sources Of Pollution

Descriptors: "Water pollution sources, "Sanitary landfills, "Groundwater, "Humic substances, "Microorganisms, Municipal wastes, Organic compounds, Organic carbon, Aerobic bacteria, Anaerobic bacteria, Actinomyces, Fungi, Aquifers.

Humic substances account for the main part of the dissolved organic carbon in groundwater. Since aquifers located near sanitary landfills usually contain higher concentrations of dissolved organic carbon, experiments were performed to determine whether humic substances can be formed from simple non-humified organic substances by a complex microflora in municipal refuse. In liquid cultures incubated for 2 months humic substances were produced, especially when casein or starch was added. The highest amounts of humic acid-like substances were yielded from cultures inoculated with the indigenous microflora from a rotted factor. substances were yielded from cultures inoculated with the indigenous microflora from a rotted (aerobic) landfill. Minor yields were obtained when the inocultum originated from a compacted (nanerobic) landfill or from a 5-year-old landfill containing refuse and sewage sludge. Spectral characteristics indicated some similarities but also differences in the UV and visible regions between the newly formed humic acids and a humic acid from groundwater (Awthers abstracted). water. (Author's abstract) W89-03079

MOVEMENT AND SURVIVAL OF BACTERIA

IN POROUS MEDIA,
Technion - Israel Inst. of Tech., Haifa. Sherman
Center for Research in Environmental and Water Resources Engineering. Y. Kott.

Water Science and Technology WSTED4, Vol. 20, No. 3, p 61-65, 1988. 7 tab, 4 ref.

Descriptors: *Path of pollutants, *Surface-ground-water relations, *Groundwater pollution, *Porous media, *Bacteria, Viruses, Sewage bacteria, Patho-genie bacteria, Wastewater, Escherichia coli, Staphylococcus, Shigella, Streptococcus, Salmo-nella, Shigella, Enterobacter, Bacteriophage, Sand, Adsorption, Aquifer, Percolation

Floodwater and flowing rivers contain bacteria and viruses from sewage and manure which may percolate to aquifers and contaminate groundwater. This study investigated the behavior of bacteria and viruses introduced with tap and other waters in sand columns. The adsorption and desorption from sand of Escherichia coli, Enterobacter aerogenes, Staphylococcus aureus, Streptococcus facaiis and Bacillus megaterium were examined. The capability of Salmonella typhimurium, S. typhi and Shigella flexneri of surviving in natural organic matter accumulated in sand was examined, as was the survival of poliovirus I and colibacteriophage in sand columns. Size and morphology of the bac-teria had no influence on the filtration efficiency. teria had no influence on the hitration efficiency.

No difference was found between Gram positive
and Gram negative bacteria. Survival of the enteropathogenic bacteria in the rich organic matter in
the column ranged up to not more than about 20
days. However, S. typhimurium survived much
longer. Poliovirus 1 was less resistant to the adverse conditions of the sand column as compared with 12 bacteriophage. However, both viruses behaved in the sand column like the bacteria, but survived for over 100 days. (Author's abstract) W89-03080

BIOLOGICAL DEGRADATION OF VOLATILE CHLORINATED HYDROCARBONS IN CHLORINATED GROUNDWATER,

GROUNDWATER, Boundesgeaundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene. G. Milde, M. Nerger, and R. Mergler. Water Science and Technology WSTED4, Vol. 20, No. 3, p 67-73, 1988. 5 fig, 9 tab.

Descriptors: *Groundwater pollution, *Chlorinat-Descriptors: "Groundwater pollution, "Chlorinat-ed hydrocarbons, "Biodegradation, "Microbial degradation, "Industrial wastes, "Fate of pollu-tants, Tetrachloroethene, Trichloroethene, Trich-loroethane, Vinyl chloride, Carcinogens, Pulp and paper industry, Metal industry, Meat processing industry, Organic solvents.

A serious case of soil, soil air and groundwater contamination by the chlorinated organic solvents

tetrachloroethene, trichloroethene and 1,1,1-trichtetrachloroethene, trichloroethene and 1,1,1-trichloroethane, (maximum concentrations detected were 500 mg/kg, 7 g/cu m, 50 mg/l respectively) is reported. Of special significance was the comparatively rapid degradation sequence of tetrachloroethene to trichloroethane to cis-1,2-dichloroethene and to vinyl chloride. Concentrations of cis-1,2-dichloroethene and vinyl chloride observed in groundwater were up to 1600 micrograms/l and 120 micrograms/l, respectively, although none of these substances were primary pollutants in the investigated area. Laboratory tests suggest that degradation of chlorinated hydrocarbons in contaminated areas is mainly by microbiological degradation of chlorinated hydrocarbons in con-taminated areas is mainly by microbiological means. This effect is of special hygienic relevance since one of the metabolites, vinyl chloride, is known to be a human carcinogen and the polluted area (approximately 4 sq km) is located in a catch-ment area of a waterworks. (Author's abstract) W89-03081

POTENTIAL OF FREE-LIVING GROUND WATER BACTERIA TO DEGRADE AROMATIC HYDROCARBONS AND HETEROCYCLIC

Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering. E. Arvin, B. Jensen, J. Aamand, and C. Jorgensen. Water Science and Technology WSTED4, Vol. 20, No. 3, p 109-118, 1988. 6 fig. 4 tab, 9 ref.

Descriptors: *Groundwater pollution, *Bacteria, *Microbial degradation, *Oil spills, *Hydrocarbons, Aromatic compounds, Biodegradation, Soil, Hydraulic conductivity, Aguifers, Soil water.

This study demonstrated that a considerable degra-Inis study demonstrated trait a considerable degra-dation potential related to aromatic hydrocarbons and aromatic N-, S-, and O-containing compounds is associated with the free-living groundwater bac-teria. All studies were performed under aerobic conditions and with surplus of N and P. After a lag period, which differs considerably between locations upstream and downstream of hydrocarbon spills, the free-living bacteria are able to degrade the hydrocarbons to concentrations less than 1 microgram/1. The bacteria from one site were able to degrade naphthalene according to a zero order reaction even at 1 microgram/1. Preliminary experiments indicate that the free-living bacteria may have a relatively high activity compared to the attached bacteria when compared on the basis of attached bacteria when compared on the basis of the same total bacteria numbers. The hypothesis is put forward that, although the attached biomass concentration in the aquifer may be much higher than the free-living biomass, the latter is still very important for the degradation capability if the at-tached bacteria are fixed in the fine soil fractions (silt, etc.), the reason being that the flow of water, and with this the flux of substrate, is relatively small due to low hydraulic conductivity in the fine soil fractions. (Author's abstract) W89-03086

EFFECT OF UNSATURATED/SATURATED ZONE PROPERTY UPON THE HYDROGEO-CHEMICAL AND MICROBIOLOGICAL PROC-ESSES INVOLVED IN THE MIGRATION AND ATTENUATION OF LANDFILL LEACHATE

ATTENUATION OF LANDFILL LEACHATE COMPONENTS,
Water Research Centre, Medmenham (England).
N. C. Blakey, and P. A. Towler.
Water Science and Technology WSTED4, Vol.
20, No. 3, p 119-128, 1988. 8 fig, 1 tab, 8 ref.

Descriptors: *Path of pollutants, *Landfills, *Leachates, *Bacteria, *Microbial degradation, *Fate of pollutants, Biodegradation, Saturation zone, Aeration zone, Aquifers, Domestic wastes.

Landfilling of domestic wastes at 'dilute and dis-Landming of domestic wastes at chiute and dis-perse sites on the two major aquifers in the U.K., the Triassic Sherwood Sandstone and the Creta-ceous Chalk, continues to highlight the vulnerabil-ity of groundwater resources. This paper describes the findings of hydrogeochemical and microbiological investigations designed to elucidate the processes of migration and attenuation of landfill leachate components which operate in the unsaturated/ saturated zone. Microbial enumeration has shown that bacteria colonize the unsaturated and saturated zones of the Chalk, and the investigated unsaturated zone profile of the Sandstone to a depth of at least 40 m. Domestic waste landfilling on the Chalk appears to result in an increased bacterial population. The high buffering capacity of this rock type has a significant impact on pollution plume development by counteracting the potentially low pH conditions, attributable to volatile acid components of landfill leachate, which inhibit biodegradation. In the Sandstone, the increased bacterial populations only correlate with horizons degradation. In the Sandstone, the increased bacterial populations only correlate with horizons where anaerobic biodegradation has been identified by pore water and gas profile analysis. The limited buffering capacity of this formation indicates that a substantial depth of unsaturated zone is required to provide dilution of landfill leachate so as to maintain biodegradation and significant atas to maintain biodegradation and significant at-tenuation of pollution plume development. Simple laboratory activity tests, using recovered core ma-terial incubated under aerobic conditions at 10 C and dosed with a range of concentrations of vola-tile acid solutions, have highlighted the constraints on biodegradation associated with low buffering capacity. The long-term objective has been to pro-vide data for landfill design assessments capable of achieving the high standards which present-day environmental pressures demand. (Author's ab W89-03087

BIODEGRADATION MODELING AT AVIA-TION FUEL SPILL SITE, Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering. For primary bibliographic entry see Field 5G. W89-03100

TEMPERATURE DEPENDENCE OF LIQUID FILM COEFFICIENT FOR GAS TRANSFER, Minnesota Univ., Minneapolis. Dept. of Civil and For primary bibliographic entry see Field 2K. W89-03112

REVERSIBILITY OF ACIDIFICATION SHOWN BY WHOLE-CATCHMENT EXPERI-MENTS.

Norsk Inst. for Vannforskning, Oslo-R. F. Wright, E. Lotse, and A. Semb. Nature NATUAS, Vol. 334, No. 25, p 670-675, August 1988. 4 fig, 3 tab, 35 ref.

Descriptors: *Acid rain, *Water pollution, *Catchment areas, Chemistry of precipitation, Norway, RAIN project.

Manipulation experiments are being conducted in Norway to examine the effects of drastic changes in precipitation chemistry on soil and surfacewater acidification. At a clean area in western Norway, two pristine catchments are being acidified by addition of H2SO4 and H2SO4 + HNO3. fied by addition of H2SO4 and H2SO4 + HNO3, respectively. These efforts are part of teh RAIN (Reversing Acidification in Norway) project. At an acidified catchment in southernmost Norway, ambient acid precipitation is excluded by means of a roof and clean precipitation added beneath. The RAIN project shows that within a few years changes in acid deposition cause major changes in surface water chemistry at sensitive sites. The reversibility of acidification demonstrated here agrees with empirical data from Canada, the United States, and Scotland. (Author's abstract) W89-03120.

CONTAMINATED AQUIFERS ARE A FOR-GOTTEN COMPONENT OF THE GLOBAL N2O BUDGET, Weizmann Inst. of Science, Rehovoth (Israel).

Weizmann inst. of Science, Renovola (Manager) Dept. of Isotope Research. D. Ronen, M. Magaritz, and E. Almon. Nature NATUAS, Vol. 335, No. 1, p 57-59, Sep-tember 1988. 3 fig. 29 ref.

Descriptors: *Groundwater pollution, *Nitrates, *Acid rain, *Path of pollutants, *Ozone layer destruction, *Aquifers, *Water pollution, *Air pollu-

Sources Of Pollution—Group 58

tion, *Ozone, Nitrogen oxides, Nitrogen compounds, Nitrogen cycle.

pounds, Nitrogen cycle.

One of the chemical components contributing to the destruction of the ozone layer in the upper atmosphere consists of the nitrogen oxides formed from N2O. Prompted by the prevailing idea that the ocean is not a major source of N2O or a sink for N2O, estimates have been made of global fluxes from continental ecosystems. Although most land areas are underlain by groundwater, this medium has never been considered in global budgeting of N2O. A large number of aquifers around the world are contaminated by nitrogen compounds, and processes of nitrification and denitrification are reported to be operative in this environment. These processes lead to the production of N2O. The concentration of N2O in phreatic aerobic dupliers contaminated by anthropogenic activities (disposal of human or animal waste, cultivation and fertilization) are up to three orders of magnitude higher than the concentration expected as a result of equilibrium with the atmosphere. (Author's abstract)

RECENT ACIDIFICATION OF A LARGE SCOTTISH LOCH LOCATED PARTLY WITHIN A NATIONAL NATURE RESERVE AND SITE OF SPECIAL SCIENTIFIC INTER-EST.

University Coll., London (England). Dept. of Geography.
For primary bibliographic entry see Field 5C.
W89-03125

MODELING OF TOTAL NITROGEN IN RIVER USING THE QUANTITY-QUALITY MODEL CEQUEAU (MODELISATION DE L'AZOTE TOTAL EN RIVIERE A L'AIDE DU MODELE QUANTITE-QUALITE CEQUEAU), Institut National de la Recherche Scientifique,

Sainte-Foy (Quebec). G. Morin, D. Cluis, D. Couillard, H. G. Jones, and

G. Morini, D. Clais, D. Collins, D. Clais, D. Collins, D. Clais, D. Collins, D. Clais, D. M. Gauthier.
Canadian Journal of Civil Engineering CJCEB8, Vol. 15, No. 3, p 315-322, June 1988. 4 fig. 5 tab, 33 ref. English summary.

Descriptors: *Model studies, *Path of pollutants, *Rivers, *Mathematical models, *Hydrologic models, *Nitrogen, Catchment areas, Nitrogen transport, Quebec, Nonpoint sources, Water pollution sources, CEQUEAU model.

A model for nitrogen concentrations in running waters has been developed and associated with the hydrologic model CEQUEAU. The model allows the simulation of total nitrogen concentrations at any point in a watershed during various hydrological events. The catchment area is first subdivided into discrete elements: each element is associated with a production function which quantifies the accumulation of nitrogen at the soil-atmosphere interface. Supplementary functions describe the transformations of nitrogen species in the soil and the transfer of the nitrogen load towards the hydrographic system by runoff (caused by rain and/or snowmelt), and the transport of the different nitrogen compounds downstream. Another function is used to represent the in-stream transformation. Nitrogen inputs to be modeled are those from precipitation dry deposition, diffuse sources due to tion. Nitrogen inputs to be modeled are those from precipitation dry deposition, diffuse sources due to agricultural practices, and industrial point sources. The model was applied to the Sainte-Anne River, Quebec (catchment area, 2700 sq. km) in order to reproduce the observed nitrogen concentrations for 1978, 1979, and 1980. Model performance was judged to be promising and it is proposed the model be validated by the simulation of nitrogen concentration on the other rivers for which land use and industrial activity are well documented. (Author's abstract)
W89-03130

INDEX OF WATER QUALITY PERMITTING ENVIRONMENTAL FOLLOW-UP AND AS-SESSMENT OF LOCAL IMPACTS (INDICE DE QUALITE DE L'EAU PERMETTANT LE SUIVI ENVIRONNEMENTAL ET LA MESURE DES IMPACTS LOCAUX),

Institut National de la Recherche Scientifique, Sainte-Foy (Quebec). For primary bibliographic entry see Field 5C.

PROBABILITY AND STOCHASTIC MODEL-LING OF WATER QUALITY PARAMETERS IN THE THAMES RIVER, Ontario Ministry of the Environment, Toronto. L. Logan, V. Graham, and T. E. Unny. Canadian Journal of Civil Engineering CJCEB8, Vol. 15, No. 3, p 430-436, June 1988. 7 fig. 5 tab, 22

Descriptors: *Water quality, *Mathematical models, *Rivers, *Probability distribution, Mapping, Time series analysis, Thames River Ontario, ARIMA process.

Baseline information on water quality parameters is essential to the development of policies to manage and control contaminants in streams. Investigations on the probability behavior of monthly statistical estimates reveal that the governing probability distributions are not fixed but change on a monthly basis; and they are non-Gaussian. Probability density functions are developed using a five-parameter polynomial density function, which allows successful preservation of the key moments of the baseline water quality sequence. Stochastic models for transformed series of concentration of total phosphorus and suspended solids are determined using the ARIMA process. Since the ARIMA family of processes requires that the underlying distributions the ARIMA process. Since the ARIMA family of processes requires that the underlying distributions for monthly events be Caussian and time-invariant, appropriate transformations are made for mapping the monthly water quality data from its parent distribution to a N(0,1) distribution. The model constructed for the transformed monthly phosphorus variable is an ARIMA (1,1,0), while the transformed suspended solids series of monthly time step is adequately described using a white noise ARIMA model. The methodology developed provides a framework for modeling baseline water quality data at various tributaries. The transformations guarantee that the probability distribution of the observed series is incorporated into the model structure. Therefore, synthetic water quality series generated using these models reproduce the nongenerated using these models reproduce the non-Gaussian time-varying probability distributions and maintain the serial relationship between consecu-tive monthly events. (Author's abstract) W89-03135

BACTERIAL LOADINGS FROM RESUSPENDED SEDIMENTS IN RECREATIONAL BEACH-ES, Beak Consultants Ltd., Brampton (Ontario).

Beak Consultants Ltd., Brampton (Ontario).
M. Palmer.
Canadian Journal of Civil Engineering CJCEB8,
Vol. 15, No. 3, p 450-455, June 1988. 3 fig, 6 tab, 7

Descriptors: *Recreation, *Recreation wastes, *Bacterial analysis, *Water pollution, *Beaches, *Sediment load, Resuspended sediments, Fecal coliforms, Public health, Toronta, Ontario.

Bacterial loadings from the resuspension of contaminated were measured in situ at three Toronto waterfront beaches and the increase in water bacwaterfront beaches and the increase in water bacterial densities due to sediment resuspension was determined. The loadings due to sediment resuspension varied from 0 to 1410 fecal coliforms/sq m /s. Sediment loadings in excess of 100 fecal coliforms/sq m/s caused significant increases in the water fecal coliform densities in shallow beach areas. Over 2970 water samples were analyzed for both fecal coliforms and Escherichia. coli and it was found that fecal coliforms and E. coli were statistically correlated. Over 1770 water samples statistically correlated. Over 1770 water samples were analyzed for both fecal coliforms and Pseudomonas aeruginosa and these bacteria were statis-tically correlated. (Author's abstract) W89-03136

GROUNDWATER CONTAMINATION AT A LANDFILL SITED ON FRACTURED CARBON-ATE AND SHALE, Waterloo Univ. (Ontario). Inst. for Ground Water

J. F. Barker, J. E. Barbash, and M. Labonte Journal of Contaminant Hydrology, Vol. 3, No. 1, p 1-25, September 1988. 6 fig. 6 tab. 27 ref.

Descriptors: *Water pollution sources, *Path of pollutants, *Groundwater pollution, *Landfills, *Leachates, *Fracture permeability, Carbonate rocks, Shales, Dolomite, Measuring instruments, Water quality, Chemical analysis, Statistical analysis, Recharge, Hydraulic gradient, Groundwater movement, Canada.

Leachate from the Upper Ottawa Street landfill site has contaminated groundwater in the underly-ing fractured dolomite and shale bedrock. An exing fractured dolomite and shale bedrock. An extensive network of multilevel groundwater monitoring devices provided a detailed, three-dimensional view of the contaminant distributions. Background groundwater quality was variable and often very poor. Many of the inorganic and organic species present in the leachate at high concentration were also present in some background groundwaters and often at equally high concentrations. In order to identify those groundwaters which were leachate-impacted, a number of tests were applied to the chemical data. These included a test utilizing 14 chemical characteristics of leachate, and statistical tests using descriptive principal-components analysis, descriptive correspondence analysis and a fuzzy-cluster analysis. The statistical tests attempted to identify a pattern in the chemical data conditions. amaysas, descriptive correspondence amaysas and a recognized conditions and a record of the statistical tests attempted to identify a pattern in the chemical data consistent with contamination superimposed upon a mixture between a recently-recharged, dilute groundwater endmember and a much older, concentrated groundwater endmember. Only sporadic leachate impact was recognized beyond 100 m from the landfill. Impact to the east indicates leachate migration towards an escarpment in the direction of the regional hydraulic gradient, perhaps in a major fracture network oriented northwest/southeast under the site. The rather minor impact of this landfill upon groundwater quality probably reflects both a low concentration of easily-recognized contaminants emanating from the landfill and a very poor groundwater quality in the sedimentary bedrock. (Author's abstract) W89-03146

GROUNDWATER CONTAMINATION BY NITRATES AND CHLORIDES WASHED OUT FROM PHOSPHORITE ORES IN THE NEGEV DESERT, ISRAEL,

Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.

K. Rosenthal, M. Magaritz, D. Ronen, and D.

Journal of Contaminant Hydrology, Vol. 3, No. 1, p 27-36, September 1988. 6 fig, 19 ref.

Descriptors: *Water pollution sources, *Path of pollutants, *Groundwater pollution, *Nitrates, *Chlorides, *Mine wastes, *Deserts, *Israel, Springs, Wastewater lagoons, Sulfates, Groundwater movement, Fracture permeability, Flow patterns, Water scarcity.

A sharp rise in the nitrate content (up to 7200 mg/L) and in the chlorinity (up to 9200 mg/L) was observed during the 1980s in the water of the Aqrabim Spring outflowing in the Negev Desert. The source of pollutants was traced to a reservoir of wastewater derived from the dressing of phosof wastewater derived from the dressing of phosphorite ores mined in the area. These ores and the overlying gravels are characterized by high concentrations of soluble nitrates, chlorides, and sulfates. Groundwater flow paths were delineated by using chemical changes observed in the wastewater reservoir. During the last 6 years, the continuous percolation of wastewater enhanced the flushing of chalk and clay particles from the fractured chert aquifer causing a sharp increase in groundwater flow rates from the reservoir to the springs from 7.5 m/day in 1980 to 53 mchange suggests the development of new flow paths. The resulting rapid propagation of the contamination plume may have disastrous consequences on the limited water resources in the northern Arava/Dead Sea area. (Author's abstract) W89-03147

Group 5B-Sources Of Pollution

SIMULATIONS OF PHYSICAL NONEQUILI-BRIUM SOLUTE TRANSPORT MODELS: AP-PLICATION TO A LARGE-SCALE FIELD EX-

Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering. For primary bibliographic entry see Field 2F. W89-03148

BIODEGRADATION OF NITROGEN- AND OXYGEN-CONTAINING AROMATIC COM-POUNDS IN GROUNDWATER FROM AN OIL-CONTAMINATED AQUIFER,
Technical Univ. of Denmark, Lyngby. Dept. of

Sanitary Engineering.

B. K. Jensen, E. Arvin, and A. T. Gundersen.
Journal of Contaminant Hydrology, Vol. 3, No. 1,
p 65-75, September 1988. 6 fig. 21 ref.

Descriptors: *Fate of pollutants, *Groundwater Descriptors: "Frate of pollutants, "Croundwater pollution, "Biodegradation, "Nitrogen compounds, "Aromatic compounds, "Oil pollution, "Aquifers, Denmark, Soil bacteria, Microbial degradation, Substrates, Cultures, Oxidation-reduction potential.

The aerobic biodegradation of oxygen and nitro-gen heterocycles and o-cresol by subsurface bacte-ria in groundwater from an oil-contaminated site at ria in groundwater from an oil-contaminated site at Zealand, Denmark, was compared to the biodegradation of these compounds in laboratory-adapted suspended and fixed-film cultures. The aquifer at the abstraction site had a relatively-high redox potential, since it contained nitrate. The groundwater (i.e., without the soil phase) had a high biodegradation potential for dibenzofuran, indole, quinoline, fluorenone, and o-cresol. All the company of the property of the company of the co bloodgradation potential for dibenzolutan, indose, quinoline, fluorenone, and o-cresol. All the compounds were degraded in groundwater within 5-15 days from an initial concentration of about 0.5 mg per L in both mixed-substrate and single-substrate experiments with an initial ATP concentration of 0.2 ng per mL. Pyrrole, however, was not degraded in groundwater within 55 days in the mixeded in groundwater within 55 days in the mixed-substrate experiment and very slowly, after a lag period of 20 days, in the single-substrate experi-ment. The biodegradability picture found for groundwater in the mixed-substrate experiment was similar to the results found with laboratory-adapted suspended and fixed-film cultures. None of the compounds had any inhibitory effect on the biodegradation of naphthalene. (Author's abstract) W89-03149

SENSITIVITY ANALYSIS OF ADSORPTION AND DEGRADATION PARAMETERS IN THE MODELING OF PESTICIDE TRANSPORT IN

SOILS, Institut National de la Recherche Scientifique, Sainte-Foy (Quebec). For primary bibliographic entry see Field 2G. W89-03150

SOLUTE TRANSPORT MODELING IN HET-EROGENEOUS SOILS: CONJUNCTIVE AP-PLICATION OF PHYSICALLY BASED AND SYSTEM APPROACHES, Hawaii Univ. at Manoa, Honolulu. Dept. of Civil

Engineering.
For primary bibliographic entry see Field 2G.
W89-03151

PREDICTING THE EFFECTS OF A PESTICIDE RELEASE TO THE RHINE RIVER,

IOW UNIV., Iowa City. Dept. of Civil and Envi-ronmental Engineering. For primary bibliographic entry see Field 5C. W89-03159

BIOLOGICAL TRANSFORMATION AND DE-TOXIFICATION DIMETHYLBENZ(A)ANTHRACENE IN SOIL

Utah State Univ., Logan.
K. S. Park, R. C. Sims, W. J. Doucette, and J. E.

Journal - Water Pollution Control Federation JWPFA5, Vol. 60, No. 10, p 1822-1825, October 1988. 4 fig, 2 tab, 13 ref. EPA CR-81079.

Descriptors: *Biotransformation. *Detoxification. Biodegradation, *Fate of pollutants, *Soil contamination, *Aromatic compounds, Microbial degradation, Toxicity.

Biological transformation and detoxification of 7,12-dimethylbenz(a)anthracene (DMBA) were studied in nonacclimated sandy loam soil. Parent 14C DMBA biodegraded extensively (62% to 20%), accompanying an increase of metabolite 14C fraction (4% to 53%). Incorporation of DMBA into non-extractable soil residue 14C increased from 12 to 17%, but the increase was not statistically significant. DMBA was transformed into several metabolic products in the soil system, including 4-hydroxy, 5-hydroxy, and 10-hydroxy-DMBA and 7,12-dihydro-12-methyl-7-methylenenz/alanthracene-12-ol. High polarity transforma-DMBA and 7,12-dihydro-12-methyl-7-methylene-benz(a)anthracene-12-ol. High polarity transforma-tion products of DMBA demonstrated a negative mutagenic response with the Ames mutagenicity assay, strain TA-100, for both low and neutral pH soils. Moderate and low polar metabolites, howev-er, induced mutagenicity for both soil samples. The mutagenicity of these metabolites decreased with incubation time in the soil, suggesting detoxifica-tion and assimilation of this polyaromatic hydro-carbon in soil systems. Mutagenic responses for the metabolites formed from low and neutral pH soil were similar. (Author's abstract)

TOTAL PHOSPHORUS BUDGET FOR LAKE ST. CLAIR: 1975-80, National Oceanic and Atmospheric Administra-tion, Ann Arbor, MI. Great Lakes Environmental

tion, Ann Arbor, MI. Great Lakes Environmental Research Lab. G. A. Lang, J. A. Morton, and T. D. Fontaine. Journal of Great Lakes Research JGLRDE, Vol. 14, No. 3, p. 257-266, 1988. 4 fig. 2 tab, 37 ref. U.S. EPA agreement DW 13931213-01-0.

Descriptors: *Phosphorus, *Lakes, *Limnology, *Lake Saint Clair, *Water pollution sources, Pollution load, Eutrophication, Great Lakes, Path of pollutants, Mathematical models, Estimating equa-

As part of the U.S.-Canadian Upper Great Lakes Connecting Channels Study, a total phosphorus budget was developed for Lake St. Clair. An unbibudget was developed for Lake St. Clair. An unpa-assed ratio estimator technique was used to estimate annual loads and variances from monitored hydro-logic areas. During the 1975-80 period, Lake Huron was the major source of phosphorus to Huron was the major source of phosphorus to Lake St. Clair, accounting for approximately 52% of the total annual load. Hydrologic area loads, which include diffuse and indirect point sources, contributed approximately 43% of the total. The remaining 5% came from the atmosphere, shore-line erosion, and direct point sources. Of the hydrologic area loads, 85% could be attributed to diffuse sources. The Thames area contributed 58% of the total hydrologic area load, followed by the Sydenham (17%), the Clinton (9%), the Ruscom (7%), the Black (6%), the St. Clair (3%), and the Rouge (0.4%). Over the entire 6-year period examined, the lake's total input and output of phosphorus were nearly equal. It was concluded that there was no significant net source or sink of phosphorus was no significant net source or sink of phosphorus in Lake St. Clair during the 1975-80 period. (Author's abstract) W89-03168

HORIZONTAL AND VERTICAL DISTRIBU-TION OF PCBS IN SOUTHERN LAKE MICHI-GAN SEDIMENTS AND THE EFFECT OF WAUKEGAN HARBOR AS A POINT SOURCE, Wisconsin Univ.-Madison. Water Chemistry Pro-

gram.
D. L. Swackhamer, and D. E. Armstrong.
Journal of Great Lakes Research JGLRDE, Vol.
14, No. 3, p 277-290, 1988. 3 fig. 3 tab, 31 ref. JRB
Assoc., Inc. Grant 2-800-03-218-02, NAOAA Sea
Grant Program R/MW-12, and U.S. EPA Contract 10853NEAX, Cooperative Agreement CR

Descriptors: *Polychlorinated biphenyls, *Aro-clors, *Lake sediments, *Water pollution sources, *Lake Michigan, Pollution load, Distribution, Path of pollutants, Great Lakes, Deposition, Vertical distribution, Chemical wastes.

The spatial distribution of PCBs in southern Lake Michigan sediments was obtained from the analysis of 66 box cores and 8 grab samples. PCB concentrations in surficial sediments were closely related to sedimentation zone and to the oxidizable organical control of the control ic matter content of the sediments. Average surfi-cial sediment concentrations ranged from 81 ng/g in depositional zones to 7.2 ng/g in non-depositional zones. The vertical distribution of PCBs was determined at several sites and was used to esti-mate the areal burden and flux of PCBs in each of mate the areal burden and flux of PCBs in each of the southern sedimentation zones. The total sediment PCB burden in the southern portion of the lake was estimated to be 5900 kg. Southern Lake Michigan has received PCBs since approximately 1930 at an average flux of 7.1 micrograms/sq m/yr. The effect of Waukegan Harbor as a point source of PCBs to Lake Michigan was evaluated by comparing the PCB distribution and Aroclor composition of harbor sediments to those of sediments of decreasing distances from the harbor. Significant differences in total PCB concentration between non-depositional zones near the harbor between non-depositional zones near the harbor and those in other areas of the basin indicate that Waukegan Harbor has influenced the PCB burden of Lake Michigan. (Author's abstract)

PHOTODEGRADATION OF THE LAMPRICIDE 3-TRIFLUOROMETHYL-4-NITRO-PHENOL (TFM): 2. FIELD CONFIRMATION OF DIRECT PHOTOLYSIS AND PERSIST-ENCE OF FORMULATION IMPURITIES IN A STREAM DURING TREATMENT,

National Water Research Inst., Burlington (Ontario). Environmental Contaminants Div.

J. H. Carey, M. E. Fox, and L. P. Schleen. Journal of Great Lakes Research JGLRDE, Vol. 14, No. 3, p 338-346, 1988. 6 fig, 2 tab, 16 ref.

Descriptors: *Fish control agents, *Degradation, *Lamprey, *Piscicides, *Lampricides, *Phenols, *Path of pollutants, Photodegradation, Stream pollution, Great Lakes, Pollutants.

The persistence of TFM in a stream receiving a lampricide treatment was evaluated. Mass balances indicated that a significant amount of TFM was unaccounted for during the treatment. The presence of five known photoproducts in the downstream samples confirmed that photodegradation of TFM was occurring. A new TFM transformation product 4,4-dinitro-2,2'-bistrifluoromethylazobenzene, was identified by mass spectrometry and confirmed by synthesis. Most of the impurities in the TFM formulation were less persistent than TFM. However, hydroxynitrobenzoic acid was more persistent than TFM. The presence of TFM transformation products in the natural system not previously observed in laboratory studies of TFM pathways emphasizes the need to conduct field studies in assessing the persistence and fate of aquatic pollutants. (Author's abstract)

DISTRIBUTION OF CONTAMINANTS IN CLAMS AND SEDIMENTS FROM THE HURON-ERIE CORRIDOR: II. LEAD AND CADMIUM.

Windsor Univ. (Ontario). Great Lakes Inst. W. Pugsley, P. D. N. Hebert, and P. M. McQuarrie.

Journal of Great Lakes Research JGLRDE, Vol. 14, No. 3, p 356-368, 1988. 9 fig, 3 tab, 33 ref. Environment Canada, Ontario Region, Contract

Descriptors: *Heavy metals, *Lead, *Cadmium, *Fluvial sediments, *Clams, *Water pollution sources, *Great Lakes, Lake Saint Clair, Stream pollution, Path of pollutants, Pollutants, Water pol-lution sources, Data collections.

The St. Clair River is a major center for the Canadian petrochemical industry, while the shore-line of the Detroit River is heavily urbanized. The extent of lead and cadmium discharge from these sources was assessed by determining contaminant concentrations in unionid clams (Lampsilis radiata siliquoidea) and sediments from 102 sites in Lake

Sources Of Pollution—Group 5B

St. Clair and from the Canadian side of the Detroit and St. Clair rivers. Overall, lead and cadmium levels in sediments averaged 20.5 and 0.18 mg/kg dry weight, respectively. These concentrations are lower than those reported in prior studies, but the decline is likely a consequence of shifts in sampling methodology and site location. Lead concentrations in clams (7.1 mg/kg) averaged only one half those in the sediments, whereas cadmium concentrations were 30 times higher in clam tissues than in the surrounding sediments. There was a significant positive correlation between lead and cadmium concentrations in sediment, and between the concentrations of both metals and the amount of organic carbon present. There was no correlation between the level of either lead or cadmium in clams and levels in the sediments from which they were collected. Patterns of variation in contaminant concentrations support the conclusion that were collected. Patterns of variation in contami-nant concentrations support the conclusion that industries along the Canadian side of the St. Clair River are the primary source of both lead and cadmium. (Author's abstract) W89-03177

DISTRIBUTION OF GAMMA-EMITTING RA-DIONUCLIDES IN SURFACE SUBTIDAL SEDIMENTS NEAR THE SELLAFIELD

PILANT,
British Geological Survey, Keyworth (England).
D. G. Jones, P. D. Roberts, and J. M. Miller.
Estuarine, Coastal and Shelf Science ECSSD3,
Vol. 27, No. 2, p 143-161, August 1988. 12 fig, 4

Descriptors: *Path of pollutants, *Radioisotopes, *Gamma radiation, *Marine sediments, *Sediments, *Radioactive wastes, In situ tests, Fuel reprocessing, Cesium radioisotopes, Ruthenium radioisotopes, Emission spectroscopy.

Detailed distributions of total gamma activity, 137Cs, 106Ru and 95Zr + 95Nb in surface seabed sediments near the Sellafield plant are presented. 137Cs, 106Ku and 95Zr + 95Nb in surface seabed sediments near the Sellafield plant are presented. The results are derived from a towed seabed gamma-ray spectrometer survey in September, 1982. All the distributions are similar, with concurs of equal activity parallel to the coast defining a 'ridge' of higher activity which is displaced northward relative to the outfall. This pattern appears to be largely a response to the transport of particle-associated radioeffluent modified in places by the type of seabed sediment present. At greater distance from Sellafield, the uptake of nuclides from solution seems to be more important. Nuclide concentrations decrease with increasing distance from Sellafield; rates of decrease being in the order Zr + Nb > Ru > Cs. This can be related to the levels of nuclides discharged, their sorption characteristics and their half lives. The pattern of seabed activity seems to have been fairly stable over the period 1978-85, but there is evidence of a small northward shift. Concentrations of 137Cs and 106Ku in 1985 were considerably lower than in 1978 or 1982. This is explicable in terms of the smail northward shift. Concentrations of 137Cs and 106Ru in 1985 were considerably lower than in 1978 or 1982. This is explicable in terms of the fall in discharge levels allied, in the case of Ru, to its short half life and, for Cs, the desorption observed in laboratory experiments. Nuclide ratios in sediment samples yield apparent transit times for the transport of nuclides in the survey area of 1.7-3.7 years. These times are generally greater than those obtained from sediments in the more distant Solway Firth and Ravenglass Estuary. It is suggested that they reflect fairly intense bioturbation causing mixing of relatively recent effluent with that from earlier discharges. This is supported by structures observed in X-radiographs of box cores, and abundant burrowing benthos and by interpretations of nuclide profiles and radiocarbon dating of sediment cores by other workers. A lag effect, of up to two years across the survey area, appears to be superimposed on that due to mixing. (Author's abstract)

CHARACTERISTICS OF THE SORPTION OF CHLOROTHALONIL AND AZINPHOS-METHYL TO A SOIL FROM A COMMERCIAL CRANBERRY BOG, Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.

S. Reduker, C. G. Uchrin, and G. Winnett.

Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 5, p 633-641, November 1988. 8 fig, 2 tab, 8 ref. N.J. Dept. Environ. Protection, Contract C-29154.

Descriptors: *Cranberries, *Bogs, *Pesticides, *Path of pollutants, *Groundwater pollution, *New Jersey, Sorption, Soil contamination, Soil water, Insecticides, Fungicides.

water, Insecticides, Fungicides.

Given the close proximity of the groundwater to the soil surface in cranberry bogs and the fact that the bulk of New Jersey's commercial bogs are located in the Cohansey aquifer recharge area, the potential for contamination of sections of the aquifer by insecticide and fungicide usage is very real. This paper describes the sorptive characteristics of 2,3,4,5 tetrachloroisophthalonitrile (chlorothalonii) and O.O-dimethyl-\$(4-exo-1,2,3-benzotrian-3(4H)-yl)methyl) phophorodithioate (Azinphos-Methyl) on soil of the Cohansey aquifer located in the southern New Jersey Coastal Plain. Soil column studies were performed and the column effluents were collected continuously and extracted every twelve hours. Very little (less than 22 percent) of the adsorbed mass of each chemical tested was recovered. This suggests that the sorptive processes are not totally reversible. Simplified models were tested for their ability to predict the observed data. In general, the models had serious difficulties in matching the data with the result that significant parameter modification had to be performed in order to obtain acceptable correspondence. (VerNooy-PTT) ence. (VerNooy-PTT) W89-03195

HEXACHLOROPHENE DISTRIBUTIONS IN

HEXACHLOROPHENE DISTRIBUTIONS IN ESTUARINE SEDIMENTS, H. R. Beller, and B. R. T. Simoneit. Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 5, p 645-650, November 1988. 2 fig, 13 ref.

Descriptors: *Bactericides, *Path of pollutants, *Estuaries, *Sediments, *Pesticides, Pesticide residues, Phenolic pesticides, Organic matter, Humic acids, Hexachlorophene.

The distribution of hexachlorophene (HCP) in sediments collected from two East coast sites was observed during or after 1980 (eight years after the U.S. FDA ban). Data were not collected on spatial distributions of HCP; rather, geochemical data were collected on the distribution of HCP among were collected on the distribution of HCP among different organic matter fractions of sediment samples. The detection of HCP was an unexpected result of a study designed to describe the distribution of three classes of organic compounds among the following three sedimentary organic matter fractions: (1) free lipids, or solvent-extractable organic matter; (2) humic acid, or base-soluble, acid-insoluble organic matter; and (3) humin, or refractory organic matter that is not soluble in solvent, base, or acid. HCP was detected only in humic acid fractions of the two samples in which it was observed. Thus, HCP can bind strongly to organic matter and appears to be highly resistant to degradation in that form. (VerNooy-PTT)

VC¹.ATILIZATION OF MERCURY COM-POUNDS BY METHYLMERCURY-VOLATIL-IZING BACTERIA IN MINAMATA BAY SEDI-MENT, National Inst. for Minamata Disease, Minamata

(Japan). Dept. of Basic Medical Science.
K. Nakamura, T. Sakata, and H. Nakahara.
Bulletin of Environmental Contamination and
Toxicology BECTA6, Vol. 41, No. 5, p 651-656,
November 1988. 4 tab, 18 ref.

Descriptors: *Methylmercury, *Mercury, *Marine bacteria, *Bacteria, *Biotransformation, Sediments, Water pollution effects, Volatility, Japan, Metabolism, Path of pollutants, Heavy metals.

Minamata Bay has been heavily polluted by high mercury concentrations and mercury still exists in the sediments of the Bay. The population of mer-cury-resistant bacteria in the sediments of Mina-mata Bay is larger than that in the sediments of

other marine environments. It is important to know what bacterial transformations of mercury have been taking place and of the volatilization of various mercury compounds by these bacteria. Tables in the article detail the total mercury concentration, the percentage of methylmercury-resistant bacteria for the total bacterial counts in the sediments, the percentage and generic composition of the methylmercury-volatilizing bacteria, and the volatilization of mercury compounds by the methylmercury-volatilizing bacteria. Methylmercury is not detectable in the sediment of Minamata Bay. The methylmercury-volatilizing bacteria may play an important role in the mercury cycle of Minamata Bay. (VerNooy-PTT) W89-03197

DDT RESIDUES IN SEDIMENTS FROM THE BAY OF BENGAL.

BAY OF BENGAL, National Inst. of Oceanography, Panaji (India). Chemical Oceanography Div. A. Sakar, and R. Sen Gupta.

A. Sakar, and K. Sen Cupta.

Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 5, p 664-669, November 1988. 2 fig, 1 tab, 10 ref.

Descriptors: *Marine sediments, *Sediments, *DDT, *Pesticides, *Pesticide residues, Halogenated pesticides, Pollutants, Path of pollutants, India.

In developing countries like India organochlorin insecticides, especially DDT are extensively being used in agriculture and vector control programs. The cumulative effects of these chlorinated pesticides over time on the coastal environment can be expected to be considerable. This work aims to assess the prevailing levels of DDT and its metabolites in the sediments from the Bay of Bengal off the east coast of India. Total DDT ranged from 0.02-0.49 ppm with a mean value of 0.02 ppm, whereas the concentrations of the six metabolites ranged from 0.01-0.35 ppm. The variations of DDT and DDT metabolite concentrations at different sites are discussed. (VerNooy-PTT) W89-03198

DISTRIBUTION PATTERN AND REDUCTION OF POLYCHLORINATED BIPHENYLS (PCB) IN BLUEFISH POMATOMUS SALTATRIX (LINNAEUS) FILLETS THROUGH ADIPOSE TISSUE REMOVAL.

National Marine Fisheries Service, Charleston, SC. Charleston Lab.

Charleston Lab.
M. Sanders, and B. L. Haynes.
Bulletin of Environmental Contamination and
Toxicology BECTA6, Vol. 41, No. 5, p 670-677,
November 1988. If fig. 3 tab, 9 ref.

Descriptors: *Tissue analysis, *Polychlorinated bi-phenyls, *Bluefish, *Fish, *Bioaccumulation, Adi-pose tissues, Path of pollutants.

pose tissues, Path of pollutants.

Two recent reports concluded that PCB concentrations for all except some of the large bluefish caught along the Atlantic coast fell below the limit of 2 micrograms/g set by FDA. Additionally, the report stated, that 15.6% of the large bluefish contain PCB concentrations that exceed the FDA limit of 2 micrograms/g. The purpose of this study was to observe the distribution pattern of PCB in the various edible tissues of large (650-850 mm total length) bluefish. Further, it was to determine if the removal of adipose tissues would result in reduced PCB level and therefore decrease PCB exposure to the consumer. Differences in PCB ratios (% PCB per zone / % fillets per zone) were found in various zones of the body. A definite dorsal to ventral gradation in PCB ratio was observed among the zones (P < 0.05). The data shows that trimming those portions of fillet which have the highest concentrations of lipid, such as the skin, dorsal fat, and the bellyflap significantly reduces PCB concentrations (micrograms/g) by 14-49%, with a mean of 27%. (VerNooy-PTT) W89-03199 W89_03199

PHOTODECOMPOSITION OF CHLORO-PHENOLS IN AQUEOUS MEDIUM IN PRES-ENCE OF HYDROGEN PEROXIDE,

Group 5B-Sources Of Pollution

Technische Univ. Muenchen, Freising (Germany, F.R.). Lehrstuhl fuer Oekologische Chemie. P. N. Moza, K. Fytianos, V. Samanidou, and F. Korte

Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 5, p 678-682, November 1988. 3 fig, 7 ref.

Descriptors: *Chlorophenols, *Fate of pollutants, *Photodecomposition, *Degradation, *Phenols, *Irradiation, Oxidation, Path of pollutants, Hydro-

Chlorophenols occur in natural waters not only because they are industrial effluents from the manufacture of fungicides and herbicides, but also be-cause they are formed by the chlorination of waste waters containing phenolic compounds. Very little is known about the indirect processes initiated by is known about the indirect processes initiated by naturally occurring active species of oxygen on the fate of higher chlorinated phenols. The objective of this paper was to obtain information about the reactivity and degradation products of monochlorophenol (2-chlorophenol), dichlorophenol (2,4-dichlorophenol) with hydroxy radicals generated in aqueous solutions by photolysis of hydrogen peroxide at wavelength > or = 290 nm. Degradation data obtained demonstrated that the photolysis of chlorophenols was strongly enhanced by hydrogen peroxide. 2-Chlorophenol, 2,4-dichlorophenol and 2,4,6-trichlorophenol disappears nearly 80%, 95% and 100% respectively in presence of 55 ppm hydrogen peroxide in 2.5 to 3 hours. From these experiments it should be concluded that indirect processes initiated by OH radicals play an imporprocesses initiated by OH radicals play an impor-tant role in the photolysis of chlorinated phenols leading to polyhydroxy, carbonyl, and dehalogen-ated products which might bear some relevance to toxic effects to aquatic life. (VerNooy-PTT)

FATE AND EFFECTS OF XANTHATES IN LABORATORY FRESHWATER SYSTEMS, Wuhan Inst. of Hydrobiology (China). For primary bibliographic entry see Field 5G.

ACCUMULATION OF CADMIUM BY RAIN-BOW TROUT, SALMO GAIRDNERI, DURING EXTENDED EXPOSURE, Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.

M. A. Giles.

Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 6, p 1045-1053, June 1988. 6 fig, 4 tab, 36 ref.

Descriptors: *Bioaccumulation, *Trout, *Population exposure, *Fish populations, *Water pollution effects, Heavy metals, Trace elements, Fish physiology, Zinc.

Adult rainbow trout, Salmo gairdneri, were exposed to 3.6 and 6.4 micrograms Cd/L for 178 days. Cadmium accumulated most rapidly in gill tissue that became saturated at levels 100-fold higher than controls within 24 and 52 days in the high- and low-metal exposures, respectively. Liver cadmium increased 250- to 400-fold over the test period but accumulation exhibited a plateau between 52 and 129 days followed by a rapid rise by 178 days. Kidney cadmium increased consistently throughout the test period to levels approximately 50- to 100-fold higher than control values. Cadmium in the gut and skin increased 10- and 5-fold, respectively, while no increase was recorded in and in the gut and sain increase up and 5-101a, respectively, while no increase was recorded in white muscle. A maximum of 2.1% of the cadmium available in a commercial diet (0.2 micrograms Cd/g dry food) was accumulated in control fish. Although cadmium was not detected in the urine, urinary zinc excretion was elevated in trout exposed to 6.4 micrograms Cd/L such that 7 mol of zinc was excreted per 1 mol of cadmium accumulated during the initial 24 days of exposure. The whole-body burden of cadmium increased linearly with time in both treatments with a time constant of 0.366 and 0.544%/day for trout exposed to 3.6 and 6.4 micrograms Cd/L, respectively. (Author's settered) Although cadmium was not detected in the urine, abstract)

SEDIMENT RECORD OF BIOGEOCHEMICAL RESPONSES TO ANTHROPOGENIC PERTURBATIONS OF NUTRIENT CYCLES IN LAKE ONTARIO, Michigan Univ., Ann Arbor. Great Lakes Re-

For primary bibliographic entry see Field 2H. W89-03222

EFFECTS OF LIMING ON THE DISTRIBU-TION OF CADMIUM IN WATER, SEDIMENT, AND ORGANISMS IN A SWEDISH LAKE, National Swedish Environment Protection Board,

National Swedish Environment Protection Board, Solna. Trace Metal Lab. P. Andersson, and H. Borg. Canadian Journal of Fisheries and Aquatic Sci-ences CJFSDX, Vol. 45, No. 7, p 1154-1162, July 1988. 9 fig, 38 ref.

Descriptors: *Lime, *Cadmium, *Lake sediments, *Lake restoration, *Acid rain effects, *Path of pollutants, *Midges, *Pike, Larvae, Suspended sediments, Heavy metals, Chemical properties, Population exposure, Chemical degradation, Oxiion-reduction potential, Organic matter.

The cadmium concentrations in water, sediment, suspended particles, a free-swimming insect larva (Chaoborus), a sediment-bound insect larva (Chironomus), and liver of northern pike (Esox lucius) before and after liming operations in Lake Langs-jon, Sweden, were studied. In accordance with the higher pH levels obtained in the lake water after ings, cadmium concentration decreased in the immings, cadmium concentration decreased in the water but increased in the sediment. Cadmium concentration in fish liver and Chironomus de-creased after the limings whereas the concentra-tion in Chaoborus larvae increased after the first liming. Possible mechanisms are discussed; for in-stance, the redox potential of the sediment can influence Cd mobility. The addition of lime might cause an increased degradation of organic matter and more reduced conditions, which would make Cd less soluble and less potentially available. The Cd concentration in sediment-bound burrowing Chironomus larvae is probably influenced mostly by conditions in deeper layers of sediment in contrast with the Cd concentration in Chaoborus, which is influenced by conditions in the bottom water and surface sediment. (Author's abstract) W89-03224

GROWTH, FECUNDITY, AND ENERGY STORES OF WHITE SUCKER (CATOSTOMUS SIOKES OF WHITE SUCKER (CATOSTOMUS COMMERSON) FROM LAKES CONTAINING ELEVATED LEVELS OF COPPER AND ZINC, Waterloo Univ. (Ontario). Dept. of Biology. For primary bibliographic entry see Field 5C. W89-03225

EFFECTS OF TEMPERATURE, SALINITY AND SEAGRASS SPECIES ON THE UPTAKE OF LEAD(II) FROM SEAWATER BY EXCISED

LEAVES,
Deakin Univ., Melbourne (Australia). Div. of
Chemical and Physical Sciences.
A. M. Bond, V. Reust, H. A. Hudson, K. R.
Arnup, and P. J. Hanna.
Marine Chemistry MRCHBD, Vol. 24, No. 3/4, p
253-260, August 1988. 4 fig, 21 ref.

Descriptors: *Temperature effects, *Salinity, *Sea

pescriptors: "temperature effects, Sainnty, segrasses, "Lead, "Path of pollutants, Seawater, Isotope studies, Lead radioisotopes, Water temperature, Plant physiology, Radioactive tracers, Ion exchange, Leaves, Heavy metals, Radiotracers.

The dynamics of the uptake of leaves of seagrass species has been investigated by 210Pb radiotracer techniques. The uptake of Pb from aqueous media per unit area of leaf by the seagrass Zostera muelleri depended on temperature and salinity. Uptake was positively correlated with temperature. Pb uptake was greatest in distilled water and least in salinities exceeding normal seawater. The profile of uptake varied only slightly between three of the species studied, namely Zostera meulleri, Heterozostera tasmanica and Halophila australis; however, uptake by Lepilaena cylindrocarpa was considerably less than the other three species. The varieties

ations were examined in relation to microscopic anatomy especially in relation to possible mecha-nisms of the uptake of Pb by seagrass leaves. The results are consistent with the view that the seagrass leaves act as passive ion-exchange media during the course of Pb uptake. (Author's abstract)

MASS BALANCE OF HEAVY METALS IN THE SETO INLAND SEA, JAPAN,
Government Industrial Research Inst., Chugoku,

Government industrial Research Inst., Chugoki, Kure (Japan). A. Hoshika, T. Shiozawa, and Y. Kitano. Marine Chemistry MRCHBD, Vol. 24, No. 3/4, p 327-335, August 1988. 4 fig. 1 tab, 10 ref.

Descriptors: *Heavy metals, *Japan, *Geochemistry, *Seto Inland Sea, *Water chemistry, *Path of pollutants, Hydrologic models, Seawater, Zinc, Sedimentation, Water pollution sources, Copper.

To discuss the geochemical and environmental behavior of heavy metals in the Seto Inland Sea, the largest semi-enclosed coastal sea in Japan, mass balances of copper and zinc were studied by application of a simple box model using sedimentation rates and heavy metal contents of core sediments. In 1980, total sedimentary loads of copper and zinc over the whole area of the sea were estimated to be 630 and 3500 tons per year, respectively. Further, the sedimentary loads with and without human activities were estimated to be 310 and 3200 tons per year for copper and 1700 and 1800 tons. To discuss the geochemical and environmental be tons per year for copper and 1700 and 1800 tons per year for zinc. Total inputs of copper and zinc into the sea in 1980 were estimated to be 870 and 4250 tons per year, about half of this being the result of human activities. Seventy percent of the copper input and eighty percent of the zinc input are taken into the sediments. Mean residence times are taken into the sediments. Mean residence times of the copper and zinc in the sea are calculated to be about 0.3 and 0.2 years, respectively. Since these values are relatively small compared to the mean residence time of the seawater (0.9 years), copper, and give unpulsed to the sea are considerate. copper and zinc supplied to the sea are considered to be accumulated rapidly in the sediments. (Author's abstract)

ESTUARIES: CONCERN OVER TROUBLED

For primary bibliographic entry see Field 7A. W89-03279

PROBABILITY DISTRIBUTION FOR CRITI-CAL DO LOCATION IN STREAMS,

Wyoming Water Research Center, Laramie. For primary bibliographic entry see Field 7B. W89-03292

MOVEMENT OF CARBOFURAN (NEMATICIDE) IN SOIL COLUMNS,
Aligarh Muslim Univ. (India). Dept. of Biology.
K. Kumari, R. P. Singh, and S. K. Saxena.
Ecotoxicology and Environmental Safety Ecotoxicology and Environmental Safet EESADV, Vol. 16, No. 1, p 36-44, August 1988. fig, 8 tab, 20 ref.

Descriptors: *Pesticides, *Nematicides, *Carbo-furan, *Path of pollutants, *Adsorption, Silt, Loam, Soil water.

Adsorption and movement of carbofuran (a systematic nematicide) were studied using two Indian soils (clay loam and silt loam) of alluvial origin. sous (clay loam and suit loam) of anuvia origin. Equilibrium adsorption coefficient (K) values measured using a batch-slurry techniques follows the order clay loam > silt loam soil. The distribution coefficients (K sub d) for both the soils in batch adsorption as well as in columns were also calculated. Carbofuran movement in soil columns during water infiltration in both air-dried and water-saturated columns was estimated. The order was anticipated from K and K sub d values. A larger amount of water was needed for leaching the carbofuran to 152 cm in clay loam soil than in silt loam soil. Carbofuran appears to increase in drier soils and in finer textured soils. (Author's

Sources Of Pollution—Group 5B

W89-03297

ASBESTOS-CONTAMINATED DRINKING ASBESTOS-CONTAMINATED DRINKING WATER: ITS IMPACT ON HOUSEHOLD AIR, New York State Dept. of Health, Albany. Wadsworth Center for Labs. and Research.

J. S. Webber, S. Syrotynski, and M. V. King. Environmental Research ENVRAL, Vol. 46, No.2, p 153-167, August 1988. 3 fig, 6 tab, 20 ref.

Descriptors: *Asbestos, *Drinking water, *Air pol-lution, *Air-water interfaces, *Water pollution ef-fects, *Carcinogens, *Path of pollutants, Water pollution, Electron microscopy.

Asbestos contamination in excess of 10 billion fibers/liter was detected in a community's drinking water. To assess the possibility of waterborne aswater. To assess the possibility of waterborne as-bestos becoming airborne, air samples were col-lected from impacted houses receiving contaminat-ed water from three control houses. Collected within each house were three samples on 0.6 micron-pore Nuclepore filters and three samples on 0.8 micron-pore Millipore filters, in addition, bulk samples suspect material and water samples were collected. Mean waterborne as-bestos concen-trations were 24 million fibers/liter in the impacted houses versus only 1.1 million fibers/liter in the trations were 24 minor noesty mer in the impacted houses versus only 1.1 million fibers/liter in the control houses. Transmission electron microscopy revealed that airborne asbestos concentrations were highest in impacted houses, with airborne were highest in impacted houses, with airborne asbestos concentrations positively correlated with waterborne concentrations. For fiber and mass measurements on both filter types, airborne asbestos concentrations were significantly higher in the impacted houses: mean concentrations in the impacted houses were 0.12 fibers/cu cm and 1.7 ng/cu m on Nuclepore filters and 0.053 fibers/cu cm and 2.3 ng/cu m on Millipore filters versus only 0.037 fibers/cu cm and 0.14 ng/cu m on Millipore filters from control houses. Also detected in the air samples form impacted houses tected in the air samples form impacted houses were clusters of chrysotile, often with several hundreds of fibers. When estimates of these individual dreds of fibers. When estimates of these individual fibers were added to the total fiber count, the difference between the impacted and control houses became even greater. The increased concentrations in impacted houses were due primarily to short fibers. Bulk samples did not reveal likely materials within impacted houses to account for these differences. Thus ligh levels of waterborne asbestos were apparently the source of increased concentrations of airborne asbestos within these houses. (Author's abstract)
W89-03299

CONCENTRATION OF MYCOBACTERIUM AVIUM BY HOSPITAL HOT WATER SYS-TEMS.

Harvard Medical School, Boston, MA. Dept. of

Anaesthesia.

G. C. du Moulin, K. D. Stottmeier, P. A. Pelletier,
A. Y. Tsang, and J. Hedley-Whyte.

Journal of the American Medical Association
JAMAA, Vol. 260, No. 11, p 1599-1601, September 16 1988. 3 tab, 17 ref. EPA Cooperative Agreement CR-812787-01-0 and NIH Contract AI-52574.

Descriptors: *Hospitals, *Mycobacterium, *Path of pollutants, *Bacterial analysis, *Water analysis, Public health, Acquired immunodeficiency syndrome, Water sampling.

Water from 34 sites on two temporarily vacant water from 34 sites of two temporarity vacant hospital floors was analyzed for the presence of mycobacteria. These sites included 18 cold taps and 16 hot water taps, including shower heads. A total of 14 sites (41%) demonstrated the presence total of 14 sites (41%) demonstrated the presence of Mycobacterium avium as confirmed by biochemical characterization, DNA/rRNA probe analysis, and seroagglutination. Of positive sites, 11 were hot water sources with an average temperature of 55 C and yielding up to 500 colony-forming units per 100 ml. Seven of 11 strains analyzed for glycolipid antigens were identified with the type 4 serovar, the preponderant serovar of M. avium in patients with acquired immunodeficiency syndrome from the Boston area. Potable hot water systems, particularly those that generate aerosols, may contain concentrations of M.yyy avium great-

er than those found in cold water systems and could serve as an environmental source for coloni-zation and infection of immunocompromised persons. (Author's abstract) W89-03304

CHRONIC EFFECTS OF CONTAMINATED SEDIMENT ON DAPHNIA MAGNA AND CHIRONOMUS TENTANS, Corvallis Environmental Research Lab., OR. For primary bibliographic entry see Field 5C. W89-03312

PESTICIDES IN FISH TISSUE AND WATER FROM TUTTLE CREEK LAKE, KANSAS, Kansas Dept. of Health and Environment, Topeka. Div. of Environment. J. A. Arruda, M. S. Cringan, W. G. Layher, G. Kersh, and C. Bever. Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 4, p 617-624, October 1988. 1 fig. 3 tab, 8 ref.

Descriptors: *Pesticides, *Pollutant identification, *Kansas, *Tissue analysis, *Bioaccumulation, *Lakes, Chlorinated hydrocarbons, Tuttle Creek

The occurrence of pesticides in fish and water from Tuttle Creek Lake was studied including a comparison of pesticides detected from water and fish and a consideration of the environmental significance of the data. Fish samples were collected in April, July and October, 1985 using gill nets. Common carp and white bass were selected as examples of a bottom feeder and an open water predator, respectively. Although atrazine, alachlor, and metolachlor were the major pesticides detected in water, none of these pesticides were detected in fish tissue. Chlordane, dieldrin, heptachlor epoxide and DDT metabolites, however, were present ide and DDT metabolites, however, were present in the lake and were detected in tisues of both in the lake and were detected in tisues of both species in equal amounts; alpha-BHC was slightly higher in carp. Differences in concentration correlated with higher concentration in the upper lake. The failure to detect atrazine in fish tissue may have been due to a real lack of significant bioaccumulation. While the levels of atrazine found in the lake are above the levels thought to impair plants, there was no demonstration of significant impacts to fish physiology, reproduction, or survival of eggs or fry. (Miller-PTT)
W89-03317

ORGANIC CONTAMINANTS IN ISOLATED LAKES OF SOUTHERN LABRADOR, CANADA,

Department of the Environment, London (Eng-

Department of the Environment, London (England). Water Engineering Directorate.

D. M. Lockerbie, and T. A. Clair.

Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 4, p 625-632, October 1988. 1 fig. 4 tab, 8 ref.

Descriptors: *Organic compounds, *Canada, *Lakes, *Path of pollutants, Tissue analysis, Water pollution, Lake sediments, Lipids, Fish.

From 1980 to 1984, the Water Quality Branch of Environment Canada studied the chemical quality of the aquatic ecosystems straddling the Labrador and Quebec border in northeastern Canada. The object of the work was to get baseline information on the aquatic resources of potential hydroelectric development sites. Measurable levels of organic contaminants were found in areas isolated from any major human activity. The results of the survey of five transboundary basins are reported. Long-range atmospheric transbort into northeastsurvey of five transboundary basins are reported. Long-range atmospheric transport into northeast-ern Canada of long-lived organic contaminants is occurring. The most water-soluble compounds are found most commonly in lake water, while the least water-soluble are found in lake sediments and fish. Though no data are available to determine what sediment characteristics control contaminant what sediment characteristics control contaminant levels, percent tissue lipid content of four fish species from two of the lakes correlated well with tissue burden. Study of tissue contaminant loads from the other three lakes shows that the highest concentrations are located in livers, corresponding

with the data from the two lakes where lipid content was measured. (Miller-PTT) W89-03318

LAGRANGIAN-EULERIAN APPROACH TO MODELING HYDROGEOCHEMICAL TRANS-PORT OF MULTI-COMPONENT SYSTEMS, Oak Ridge National Lab., TN. Environmental Sci-

ences Div G. T. Yeh, and V. S. Tripathi.

G. T. Yeh, and V. S. Tripathi.
Available from the National Technical Information Service, Springfield, VA 22161, as DE88-004738.
Price codes: A03 in paper copy, A01 in microfiche.
Report No. CONF-8710414—4, (1987). 16p, 1 fig, 9 ref. DOE Contract DE-AC05-84OR21400.

Descriptors: *Lagrangian equations, *Eulerian equation, *Advection, *Mathematical models, *Path of pollutants, Geochemistry, Geohydrology, Mathematical equations, Mathematical studies.

For advection-dominated hydrogeochemical transport problems, negative concentration can occur especially in sharp front cases when traditional numerical methods of finite element or finite difference are used to solve the governing equations. Negative concentration, in addition to being illogical, also gives two undesired effects. First, it can easily tumble into nonconvergent solutions. Second, existing chemical equilibrium models are unable to deal with negative concentrations: thus easily tumble into nonconvergent solutions. Second, existing chemical equilibrium models are unable to deal with negative concentrations; thus the computation will be stymmied when negative concentrations occur even if they are small and do not affect the overall convergent solutions. Upstream weighting methods can be used to circumvent these problems, but only with rectangular grid layout. A Lagrangian-Eulerian approach is employed to overcome the problems of negative concentration. In this approach, one adopts a Lagrangian is ewpoint when dealing with the advective terms and an Eulerian viewpoint when dealing with the advective terms and an Eulerian viewpoint when dealing with the advective step is contingent on the means by which a concentration value of a fictitious particle is approximated by that of the node values surrounding the particle. It is shown that a linear interpolation is equivalent to the upstream weighting scheme with the Courant number less than or equal to one. The Lagrangian approach of the advection terms offers, even for the cases of a rectangular grid system, one advantage over the upstream weighting scheme in that the Courant number does not have to be less than or equal to one. This greatly relieves the sever restriction on the time step size ing scheme in that the Courant number does not have to be less than or equal to one. This greatly relieves the severe restriction on the time step size imposed by the upstream weighting scheme. Other nonlinear interpolations are explored to increase the accuracy in the Lagrangian step of dealing with the advection terms. Several examples are used to demonstrate the utility and versatility of the Lagrangian-Eulerian approach to solving hy-drogeochemical transport problems. (Author's abstract) W89-03320

MODELING GROUNDWATER TRANSPORT OF DISSOLVED GASOLINE AND USING THE RESULTS TO EVALUATE AQUIFER RESTO-RATION PROCESSES, Argonne National Lab., IL. Energy and Environ-mental Systems Div.

mental Systems Div. S. C. L. Yin, and S. Y. Chiu. Available from the National Technical Information Service, Springfield, VA 22161, as DE88-006011. Price codes: A03 in paper copy, A01 in microfiche. Report No. CONF-8705260-1, (1987). 11p, 4 fig, 1 tab, 14 ref. DOE Contract W-31-109-Eng-38.

Descriptors: *Path of pollutants, *Groundwater movement, *Gasoline, *Aquifers, *Model studies, Solute transport, Simulation analysis, Xylene, Ben-zene, Organic compounds, Permeability coeffi-cient, Hydrocarbons.

Solute transport models can be used to simulate aquifer restoration processes for groundwater con-taminated by dissolved gasoline. Generic aquifer restoration problems, representing a generalized

Group 5B-Sources Of Pollution

contamination case for a typical range of aquifer characteristics, were formulated for simulation by a selected solute transport model. The results of the simulations were used to evaluate the feasibility and effectiveness of aquifer restoration by pumping out the contaminated water. The aquifer restoration process consists of a single well located at the center of the contaminated area to pump the groundwater at constant rates of 400, 50, and 5 cms. for these selected aquifer cases, reconstitutions. groundwater at constant rates of 400, 50, and 5 gpm for three selected aquifer cases, respectively. The pumping rates were selected such that the maximum well drawdown in all three cases is about 10 feet after 20 years of pumping. The modeling results indicate that the time of pumping required to reduce hydrocarbon concentrations down to acceptable levels is quite sensitive to hydraulic conductivity of the aquifer and retardation factors of the hydrocarbons. The aquifer cases considered in the restoration problem had hydraulic conductivities, respectively, of 5000, 500, and 50 gpd/sq ft. Each aquifer was assumed to be unconfined and to be 20 ft thick. The gasoline-contaminated area in each case was assumed to be 100 ft by 200 ft, with a uniform concentration of hydrocarbons. The removal of two hydrocarbons 100 ft by 200 ft, with a uniform concentration of hydrocarbons. The removal of two hydrocarbons (benzene and xylene) was simulated by the transport model. The initial concentrations of benzene and xylene were assumed to be 25 ppm and 10 ppm, respectively, which appear to be typical for actual contamination cases. For Case 1 aquifer (hydraulic conductivity of 5000 gpd/sq ft) predicted hydrocarbon concentrations vs. time indicate that the concentration of benzene reduces to 10 pph after about four years of numping. For Case 2 ppb after about four years of pumping. For Case 2 aquifer (hydraulic conductivity of 500 gpd/sq ft) the pumping time required to reduce benzene con-centration to 10 ppb was found to be about 18 years. For xylene, the Case 2 concentration could be reduced only to about 100 ppb after 20 years. For Case 3 aquifer (hydraulic conductivity of 50 gpd/sq ft) the concentrations after 20 years could only be reduced to about 300 ppb for benzene and 800 ppb for xylene. (Author's abstract)

RATIONALE FOR THE DESIGN OF MONITORING WELL SCREENS AND FILTER

FAU.S., Battelle Pacific Northwest Labs., Richland, WA. R. Schalla, and W. H. Walters. Available from the National Technical Information Avanaote from the National 1 ecnnical information Service, Springfield, VA 22161, as DE88-005630. Price codes: A03 in paper copy, A01 in microfiche. Report No. PNL/SA-1538, January 1988. 23p, 4 fig. 21 ref. DOE Contract DE-AC06-76RLO 1830.

Descriptors: *Well screens, *Design standards, *Monitoring wells, *Filters, Wells, Filtration, Hydraulic design, Aquifers, Monitoring.

Well screens and filter packs are used extensively in the water well industry. Water supply wells are designed with large diameters to accomodate high capacity pumps for municipal, industrial, and irrigation uses. Monitoring wells serve a different purpose, thus have some different design requirements. Meditoring wells served and industrial and income and incom purpose, thus have some different design require-ments. Monitoring wells are used to collect groundwater samples for chemical evaluation and are typically smaller in diameter and have shorter screened intervals. Monitoring well design, par-ticularly well screens and filter packs, must meet specific requirements. Unlike water wells, monitor-ing wells usually have an artificial pack and often a ing wells usually have an artificial pack and often a secondary filter between the formation and well screen. The designs of well screens and filter packs are more critical for monitoring wells than for water wells, because monitoring wells streas a sampling ports in an aquifer and must minimize disturbance of water chemistry and hydrology. Currently, screen and filter pack requirements for monitoring wells have been only partially addressed by the technical community. Specific technical requirements should include filter pack parameters (i.e., uniformity coefficient, effective size, kurtosis, skewness, roundness, sphericity, and minrameters (i.e., uniformity coefficient, effective size, kurtosis, skewness, roundness, sphericity, and mineralogy). The method of filter pack placement, which involves particle settling through borehole fluids, is also important, particularly in relation to the nature of the geologic materials, the slot type and size of the screen, and the water level in the well. (Author's abstract) W89-03332

5C. Effects Of Pollution

EFFECTS OF ATMOSPHERIC POLLUTANTS ON FORESTS, WETLANDS AND AGRICULTURAL ECOSYSTEMS.

For primary bibliographic entry see Field 5B. W89-02304

INTERACTIONS OF SPHAGNUM WITH WATER AND AIR,
Queen Mary Coll., London (England). School of Biological Sciences.
For primary bibliographic entry see Field 2H.
W89-02312

SOURCES OF ALKALINITY IN PRECAMBRIAN SHIELD WATERSHEDS UNDER NAT-URAL CONDITIONS AND AFTER FIRE OR ACIDIFICATION, Manitoba Univ., Winnipeg. Dept. of Botany. For primary bibliographic entry see Field 2G. W89-02313

RESPONSES TO ACIDIC DEPOSITION IN OMBOTROPHIC MIRES IN THE U.K., Manchester Univ. (England). Dept. of Botany. For primary bibliographic entry see Field 5B W89-02314

STRATEGIES FOR LONG-TERM POLLUTION MONITORING OF THE COASTAL OCEANS, California Univ., Richmond. Sanitary Engineering and Environmental Health Research Lab. For primary bibliographic entry see Field 5A. W89-02319

PROCEEDINGS OF THE FOCUS CONFERENCE ON SOUTHWESTERN GROUND WATER ISSUES.

bibliographic entry see Field 2F.

MODELING THE RESPONSE OF LAKE-AQUI-FER SYSTEMS TO ACID PRECIPITATION, New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.

Socorro. Dept. of Geoscience.
J. T. McCord, T. C. J. Yeh, and J. Yeh.
IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 165-179, 6 fig, 2 tab, 13 ref.

Descriptors: *Water pollution effects, *Fisheries, *Lake-aquifer systems, *Acid rain, *Model studies, *Limnology, *Water quality, Hydrogen ion concentration, Chemical reactions, Water chemistry, centration, Chemical re Aquifers, Groundwater.

The occurrence of acid precipitation in the south-western United States is a recently recognized phenomena which could have significant detrimen-tal environmental impacts. Perhaps the most sus-ceptible ecosystems to continued acid loading are high elevation lakes and their associated fisheries. In the past, approaches used to quantify the effects of acid rain on surface waters have included empirical relationships, statistical models, and determi-nistic watershed models. A simple water and solute nistic watershed models. A simple water and solute balance for a small basin is used to develop a lumped parameter model to predict groundwater and surface water quality as a function of time. The advantages of this approach over numerical modeling methods include: (1) the relatively simple calculations involved which could be performed using a hand-held calculator, and (2) a better understanding gained through the analytical solution. The model, which is developed initially for the general case, is applied to predict the pH response of a wide variety of hypothetical lake systems to acid precipitation. Even when the effects of buffering reactions in the surface waters are ignored, groundwater inputs can help attenuate the impacts groundwater inputs can help attenuate the impacts of acid deposition on lake pH. However, the relatively small basin size of most of the acid-sensitive in the southwestern U.S. tends to minimize

the buffering effects provided by groundwater. (See also W89-02331) (Author's abstract) W89-02341

EFFECTS OF ACID MINE DRAINAGE ON GROUNDWATER QUALITY AT THE LEVIATHAN SULFUR MINE, ALPINE COUNTY,

Groundwater Technology, Inc., Sacramento, CA

Orounwater Teamology, inc., Sacramento, CA. J. Sciacca, and R. Matthews.

IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 579-602, 12 fig, 2 tab, 11 ref.

Descriptors: *Water pollution effects, *Water pol-lution treatment, *Acid mine drainage, *Water pol-lution sources, *Mine wastes, *Groundwater pollution, Hydrogen ion concentration, Heavy metals, Path of pollutants, Infiltration, Geohydrology, Hydrology, Aquifers, Sulfides.

Low pH values ranging from 6.3 to 1.6 are common in groundwater samples collected throughout the tailings and open pit areas of the Leviathan Sulfur Mine. The distribution of pyrite Leviathan Sulfur Mine. The distribution of pyrite throughout the mine site and associated low pH in groundwater, in part supports previous geochemical studies linking the reaction of pyrite and groundwater (forming sulfuric acid) to the formation of acid mine drainage. Throughout the mine site, pyrite is present as: (1) disseminated masses in association with elemental sulfur (ore) within the pit area; (2) lining vugs and disseminated in a silicarich jasperoid 'caprock' up section of the ore body' and (3) within broken fragments of (1) and (2) above, distributed throughout the tailings. High groundwater concentrations of arsenic, nickel, thallium and other heavy metals correspond to low pH values within the open pit and waste dump areas. Decreasing groundwater pH and increasing metals concentrations with depth (within the pit) result from the cumulative oxidation of sulfides as water percolates through the pit walls and floor. Intensified degradation of groundwater quality has resulted from mining practices by: (1) the destruction of vegetation capable of removing water from the oxidation process; (2) creating the open pit and other depressions which intensified infiltration; and (3) increasing the surface area of pyrite exposed to the reaction process and distributing it across the groundwater basin. While a multi-million dollar surface water remediation system has been installed at the site, relatively little is known of its impact on groundwater quality as all but one of the pre-existing piezometers within the open pit have now been destroyed during regrading operations. (See also W89-02331) (Author's abstract) throughout the mine site and associated low p W89-02363

WATER QUALITY DATA FOR THE BOISE RIVER, BOISE TO STAR, IDAHO, OCTOBER TO DECEMBER 1987, Geological Survey, Boise, ID. Water Resources

S. A. Frenzel, and T. F. Hansen, Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 88-171, 1988. 11p, 1 fig, 2 tab, 12 ref.

Descriptors: *Water pollution effects, *Boise River, *Water quality, *Benthic invertebrates, *Idaho, Wastewater treatment, Trace elements, Low flow, Artificial substrates

Chemical and physical data were collected at six and biological data at five sites on the Boise River between Veterans Memorial Parkway in Boise and Star, Idaho, from October to December 1987. Data were collected to determine the impact of sewage were collected to determine the impact of sewage effluent from two Boise wastewater treatment plants on the water and biological quality of the Boise River. Similar data will be collected from January to March 1988 and will be published in a second noninterpretive report. Results of all data analyses will be discussed in a final interpretive report. (USGS) W89-02464

Effects Of Pollution—Group 5C

AGRICULTURAL IMPACT ON GROUNDWAT-ER QUALITY, Purdue Univ., Lafayette, IN. Water Resources Re-

For primary bibliographic entry see Field 5B. W89-02549

EFFECTS OF HEAVY METAL POLLUTION ON EPILITHIC BACTERIA, Purdue Univ., Lafayette, IN. Dept. of Biological

D. D. Ross.

Available from the National Technical Information
Service, Springfield, VA 22161 as PB88-235775/
AS. Price codes: A03 in paper copy; A01 in microfiche. Water Resources Research Center, Purdue
Univ., West Lafayette, IN. Technical Report No.
184, June 1988. 38p, 15 tab, 19 ref. Contract No.
14-08-0001-G1421. Project No. USGS G1421-04.

Descriptors: *Water pollution effects, *Epilithic bacteria, *Zinc, Periphyton ATP, Heavy metals, Aufwuchs, Environmental effects, Aquatic ecosystems, Biomass, Chlorophyll, Heterotrophic bacteria, Hydrogen ion concentration

The effects of zinc on the bacterial component of periphyton were studied in artificial outdoor streams. Parameters used to measure the response of aufwuchs were biomass, chlorophyll, total and viable bacterial numbers, ATP, heterotrophic acviable bacterial numbers, ATP, heterotrophic activity, and bacterial resistance to zinc. In an experiment to define the dose-response relationship of aufwuchs to zinc, duplicate streams were dosed with 0.01, 0.1, 0.5, 1.0, and 10.0 ppm zinc while one set of streams received no zinc supplements. Streams were sampled at weekly intervals. A statistically significant difference was seen with respect to all parameters between the low zinc treatments (control, 0.01, and 0.1 ppm zinc). The bacterial components of aufwuchs showed the capacity to adapt to the exposure level of zinc, but was inhibited by concentrations of zinc above the exposure level. In a second experiment, pH was introduced as a covariable with zinc. This experiment exposure level. In a second experiment, pH was introduced as a covariable with zinc. This experiment utilized a 2 x 3 factoral design, where the zinc concentrations were 0.1 and 0.5 ppm and the pHs were 8.5, 7.0, and 5.5. With respect to all parameters, zinc was significantly more toxic under neutral and acid conditions than under alkaline conditions. (Cushman-Purdue Univ., WRRC)

SOOT FROM ARCTIC HAZE: RADIATIVE EF-FECTS ON THE ARCTIC SNOWPACK, Washington Univ., Seattle. Dept. of Atmospheric Sciences.

For primary bibliographic entry see Field 2C. W89-02611

CO2-INDUCED CHANGES IN SEASONAL SNOW COVER SIMULATED BY THE OSU COUPLED ATMOSPHERIC-OCEAN GENERAL CIRCULATION MODEL, Oregon State Univ., Corvallis. Climatic Research Loss

For primary bibliographic entry see Field 2C. W89-02629

TRANSPORT, BIOACCUMULATION, AND TOXICITY OF METALS AND METALLOIDS IN MICROORGANISMS UNDER ENVIRONMENTAL STRESS, Gray Freshwater Biological Inst., Navarre, MN. For primary bibliographic entry see Field 5B. W89-02652

NORTH ALABAMA WATER QUALITY AS-SESSMENT, VOLUME VIII - WATER QUAL-ITY MODELING, Tennessee Valley Authority, Norris. Engineering

For primary bibliographic entry see Field 5B. W89-02702

SPIRIT LAKE, MOUNT ST. HELENS, WASH-INGTON, LIMNOLOGICAL AND BACTERIO-

LOGICAL INVESTIGATIONS, FI REPORT, VOLUME I, Army Engineer District, Portland, OR. For primary bibliographic entry see Field 2H. W89-02709 FINAL.

PESTICIDE IMPACT ON STREAM FAUNA WITH SPECIAL REFERENCE TO MACROIN-VERTEBRATES,

Royal Holloway and Bedford New Coll., Egham

(England).
R. C. Muirhead-Thomson.
Cambridge University Press, New York. 1987. 275

Descriptors: *Pesticides, *Water pollution effects, *Streams, *Macroinvertebrates, *Water pollution sources, *Path of pollutants, Chemical analysis, Pollutant identification, Case studies, Aquatic environment, Insecticides, Larvicides, Piscicides, Molluscicides, Tsetsefly, Black fly, Spruce budworm,

Pesticides and freshwater fauna are reviewed, with Pesticides and freshwater fauna are reviewed, with the discussion limited to running waters, rivers and streams, and to the macroinvertebrate fauna of these water bodies. Studies on the reactions of the freshwater fish are considered only in relation to the effects of pesticides and allied toxic chemicals on feeding habits of fish insofar as these are influenced by drastic changes in the availability of different invertebrate fish food organisms, as measured by a hospital state of the second state of emeet by drastic changes in the availability of different invertebrate fish food organisms, as measured by changes in the composition of the stomach contents. Studies on pesticide impact in recent years have been greatly assisted by technical advances in physicochemical methods for determining pesticide residues in various components of the aquatic environment, including vegetation, silt and water, as well as in the aquatic organisms themselves. Many widely used pesticides can now be detected in water at levels as low as 0.1 micrograms/L. This book aims not so much to summarize or catalogue information available from published reports, but to examine the great variety of methods that have been used to provide this basic knowledge. Three aspects of pesticide contamination are considerated: the origins of the pollutants; a consideration of laboratory evaluation techniques; consideration of laboratory evaluation techniques; and a selection of case studies in which the effects and a selection of case studies in which in effects on streams of widely used pesticides are analyzed. The effects are considered of insecticides used in control of the spruce budworm, insecticides used to control the tsetse fly, larvicides used to control black fly larvae, piscicides and molluscicides, and herbicides. (Lantz-PTT) W89-02773

ACIDIFICATION OF FRESHWATERS, Aberdeen Univ. (Scotland). Dept. of Soil Sci For primary bibliographic entry see Field 5B. W89-02774

ORGANIC CHEMICALS IN NATURAL WATERS: APPLIED MONITORING AND IMPACT ASSESSMENT,
Alberta Environmental Centre, Vegreville.
J. W. Moore, and S. Ramamoorthy.
Springer-Verlag, New York. 1984. 289p.

Descriptors: *Organic compounds, *Water pollution effects, *Natural waters, *Water quality control, *Water pollution sources, Path of pollutants, Environmental effects, Aliphatic hydrocarbons, Aromatic compounds, Pesticides, Hydrocarbons, Phenols, Polychlorinated biphenyls, Dioxin, Toxicity, Chemical analysis, Priority pollutants.

This volume on monitoring and assessment of the impacts of chemical pollutants in natural waters considers organic compounds outlined in the priority pollutant list (EPA) and Environmental Contaminants Act (Canada) and includes aliphatic taminants Act (Canada) and includes aliphatic compounds, aromatic compounds, chlorinated pesticides, petroleum hydrocarbons, phenols, polychlorinated biphenyls, and polychlorinated disperacy-dioxins. Most of these chemicals are widespread in the environment and toxic to fish and humans; many are mutagenic, carcinogenic, and teratogenic. A multidisciplinary approach is em-

phasized, with extensive reviews of the chemistry, production, uses, discharges, behavior in natural waters, uptake, and toxicity of organics. This is followed by a description of criteria for prioritizing chemical hazards posed to users of aquatic resources. Several recommendations are made with the intention of improving current monitoring techniques. (Lantz-PTT)
W89-02776

SUMMARY OF MARYLAND STREAM PH AND ALKALINITY DATA: ANALYSIS OF ITS APPLICATION TO ASSESSING THE IMPACTS OF ACIDIC DEPOSITION,

OF ACIDIC DEPOSITION, Versar, Inc., Columbia, MD. A. Janicki, and H. Greening. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-186309. Price codes: A04 in paper copy, A01 in microfiche. Report No. AD-87-11, September 1987. 54p, 14 fig, 5 tab, 29 ref, 3 append.

Descriptors: *Water pollution effects, *Streams, *Hydrogen ion concentration, *Alkalinity, *Acid rain, Maryland, Chemical analysis, Water quality, Soil properties, Water analysis.

Soil properties, Water analysis.

Stream chemistry data were gathered from a number of sources to characterize the sensitivity of flowing waters in Maryland to acidification, as well as to provide baseline information for the design of a synoptic survey of stream chemistry conducted in 1987. Overall, 19% of Maryland streams, for which data were collected, exhibit mean alkalinity values of < 200 microeq/L, generally considered to be indicative of waters sensitive to acidification. Minimum alkalinity values < 200 microeq/L were found in 41% of the data sets examined. Mean pH values < 6.0 have been observed in about 9% of the streams for which data were identified. Minimum pH values less than 6.0 were observed in 24% of the streams. For the most part, streams located in the Appalachian Plateau and Coastal Plain physiographic provinces are most likely to exhibit lower alkalinity ard pH values. Conversely, those streams found in the Valley and Ridge and Piedmont provinces general-yearthity conditions which indicate their relative insensitivity to acidification. These differences in stream sensitivity are closely related to the geologic and soil characteristics of the watersheds which surround these streams. (Author's abstract)

INTENSIVE SURVEY OF THE KISHWAUKEE RIVER AND ITS TRIBUTARIES, 1983.

RIVER AND ITS TRIBUTARIES, 1983.

Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control.

Available from the National Technical Information Service, Springfield, VA. 22161, as PB88-188602.

Price codes: A04 in paper copy, A01 in microfiche. Report No. IEPA/WPC/88-009, January 1988.

600. 1 fig. 12 tab. 15 or 4 appared. 60p, 1 fig, 12 tab, 15 ref, 4 append

Descriptors: *Water pollution sources, *Path of pollutants, *Illinois, *Kishwaukee River, *Water quality, *Water pollution effects, Macroinvertebrates, Fish, Sediment, Ecosystem, Coliforms, Iron, Cyanide, Fluoride, Conductivity, Copper, Mercury, Silver, Phosphorus, Suspended solids, Pluores

Twenty-five stations on the Kishwaukee River and tributaries were sampled for water and sediment quality, macroinvertebrates, fish and habitat in 1983. From these data, environmental quality was summarized utilizing various indices including water quality (WQI), macroinvertebrates (MBI), fish (AIBI), and habitat (PIBI). Individual stations fish (AİBI), and habitat (PIBI). Individual stations were evaluated for degree of support of aquatic life and classification system used for Illinois streams. All mean index values indicated good to very good environmental conditions providing full aquatic life use at 22 of 25 stations (88%). Mean index values were 24.1 (WQI) for water, 5.3 (MBI) for macroinvertebrates, 45 (AIBI) for fish and 44 (PIBI) for habitat. According to the biological stream classification system, 56% of the stations were classified as B (highly valued aquatic re-

Group 5C-Effects Of Pollution

source), 20% as A (unique aquatic resource) and 24% as C (moderate aquatic resource). Based on water quality index (WQI) values, total phospho-rus and total suspended solids are the primary water quality problems in the basin. Total suspend-ed solids, fecal coliform and total iron levels in the ed solids, fecal coliform and total iron levels in the Kishwaukee basin were more related to nonpoint sources, while elevated levels of total phosphorus, cyanide, fluoride, conductivity, copper and mercury were associated with point source discharges. Overall, there were minimal water quality problems in the Kishwaukee basin. Kishwaukee basin sediments had the highest mean concentrations of Kjeldahl nitrogen and iron and the second highest levels of volatile solids, chemical oxygen demand (COD) and manganese in northern Illinois stream sediments. (Lantz-PTT) W89-02838

AMBIENT WATER QUALITY CRITERIA FOR CHLORIDE - 1988, Environmental Research Lab., Duluth, M.N.

For primary bibliographic entry see Field 5G.

SURVEY OF SENSITIVITY OF SOUTHERN CALIFORNIA LAKES TO ACID DEPOSITION, California Univ., Santa Barbara. Dept. of Biologi-

cal Sciences.

J. M. Melack, and F. Setaro.

Available from the National Technical Information
Service, Springfield, VA. 22161, as PB88-1822654.

Price codes: A04 in paper copy, A01 in microfiche.

Final Report, September 30, 1986. 73p, 5 fig, 27
tab, 39 ref, append. California Air Resources
Board Contract A3-107-32.

Descriptors: *California, *Surveys, *Water pollution effects, *Lakes, *Acid rain, Seasonal variation, Chemical analysis, Hydrogen ion concentration, Alkalinity, Calcium, Magnesium, Sodium, Potassium, Nitrates, Sulfates, Chlorides, Silica, Nutrients, Aluminum, Iron, Manganese, Ice.

During 1985-1986 solute composition of 23 California lakes and ponds and of streams entering the lakes was determined. The strategy was to sample has makes and points and or streams entering the lakes was determined. The strategy was to sample the same waters during the autumn and under ice or soon after ice out and to evaluate the necessity of sampling at multiple stations and from more than one depth. Chemical parameters measured included pH, alkalinity, conductance, major cations (calcium, magnesium, sodium, and potassium), major anions (nitrate, sulfate, chloride), silica, nutrients (ammonium and phosphate), total and total dissolved nitrogen and phosphorus, and total and dissolved levels of aluminum, iron, and manganese. Coastal ponds and low elevation (<1700 m) lakes exhibited circumneutral to alkaline pH, high alkalinity (500-600 microcq/L) and high levels of dissolved ions (20-150 millieq/L). Among the high altitude (>1800 m) lakes, pH was circumneutral to slightly acid and alkalinity was 100 (16-338 millightly acid and alkalinity was 100 (slightly acid and alkalinity was low (16-338 mi-croeq/L). Insignificant spatial variation in pH, alkalinity and dissolved constituents was observed in these lakes during September-October 1985 and July-August 1986. Under ice cover in May 1986 lakes had vertical differences in alkalinity and other constituents. Dissolved and total nutrient determinations for Sierra Nevada lakes suggested that the availability of nitrogen is greater than that of phosphorus. Trace element levels for total aluminum (<22 microgm/L), total iron (< 73 microgm/L), and total manganese (<11 microgm/L) were very low in autumn 1985, increased slightly under ice-cover (but were less than 81, 390, 17 microgm/L, respectively) and were somewhat higher than the previous autumn in July-August 1986 for high altitude lakes with aluminum exhibiting the greatest and manganese the smallest change. Levels of chemical constituents in lakes sampled previously (1981 through 1984) or monitored by other surveys were within range of values observed. (Author's abstract) W89-02864 of phosphorus. Trace element levels for total alu-

HEALTH AND ENVIRONMENTAL EFFECTS PROFILE FOR 1,2,3,4,5-PENTA-BROMO-6-CHLOROCYCLOHEXANE. ental Protection Agency, Cincinnati,

OH. Office of Research and Development. Available from the National Technical Information Service, Springfield, VA. 22161, as PB88-182225. Price codes: A04 in paper copy, A01 in microfice. Report No. EPA/600/X-85/402, June 1985. 55p, 15 tab, 42 ref, append.

Descriptors: *Pentabromochlorocyclohexane, *Environmental effects, *Public health, *Water pollution effects, Fathead minnows, Bioassay, Daphnia, Toxicity, Bioaccumulation, Path of pol-

The chemical, 1,2,3,4,5-pentabromo-6-chlorocyclo-hexane, is also known by the synonyms PBCC and pentabromochlorocyclohexane. The trade name for the product made commercially by Dow Chemical is FR-651. Pentabromochlorocyclohexane entering the aquatic environment may be ex-pected to adsorb significantly to sediment and susane entering the aquatic environment may be expected to adsorb significantly to sediment and suspended particulate matter where, based on soil degradation studies, rapid biodegradation may occur. Photolysis may play some role, but the degree of importance is not clear. Volatilization will occur at a slow, and perhaps, unimportant rate. Aquatic organisms exposed to pentabromochlorocyclohexane can be expected to strongly bioaccumulate the compound. In the soil environment, pentabromochlorocyclohexane can be expected to be tightly sorbed (with insignificant leaching) and be quickly biodegraded. Pentabromochlorocyclohexane (FR-651A) at 20 mg/L had no observable adverse effects on fathead minnows during a static 96-hr bioassay. Following 72-hr exposures, 2.0 mg/L was reported as the maximum safe level of pentabromochlorocyclohexane for the lake emerald shiner, although some mortality occurred at 3.0 mg/L. In 48-hr toxicity tests of pentabromochlorocyclohexane (FR-651A) on the freshwater crustacean, Daphnis magna, at a level 21.0 mg/L, no adverse effects were observed. Based on the log octanol-water partition coefficient of pentabromochlorocyclohexane, a BCF (biocontration factor) of 2400 for trout muscle was estimated. Pertinent guidelines and standards were estimated. Pertinent guidelines and standards were not located in the available literature. (Lantz-PTT) W89-02866

HEALTH AND ENVIRONMENTAL EFFECTS PROFILE FOR PHENYLENEDIAMINES. Environmental Protection Agency, Washington, DC. Office of Health and Environmental Assess-

ment. Available from the National Technical Information Service, Springfield, VA. 22161, as PB88-182191. Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA/600/X-85/113, April 1985. 65p, 11 tab, 90 ref, 4 append.

Descriptors: *Phenylenediamine, *Environmental effects, *Public health, Organic compounds, Fate of pollutants, Photolysis, Photooxidation, Leaching, Path of pollutants.

Phenylenediamine is the generic name for a large number of substituted diaminobenzenes. Unless specifically stated, the name, phenylenediamine, when used in this document, refers only to the unsubstituted three isomeric phenylenediamines, odiaminobenzenes (1,2-benzenediamine) and p-diaminobenzene (1,4-benzenediamine). Based on the available information specific to phenylenediamines and information specific to phenylenediamines and some generalizations concerning aromatic amines, the dominant fate processes for these compounds appear to be photolysis or photooxidation in the atmosphere and photooxidation and radical oxidaatmosphere and photosynaturing and radial variation in water. Biodegradation may occur, but most studies show this to be a slow process. No information was available concerning the fate of phenylenediamines in soil; however, leaching is expected to be important. It was reported in an abstract of a Russian study that solutions of 1, 5 and 10 mg/L p-phenylenediamine were toxic to 100% of Daphnia in 25 hrs allowed to stand for 5-6 days, but the 10 mg/L solution was toxic to 50%. (Lantz-PTT) W89-02868

PRELIMINARY ENVIRONMENTAL ASSESSMENT OF THE CONTAMINATION ASSOCIATED WITH LAKE CALUMET, COOK COUNTY, ILLINOIS,

Illinois State Water Survey Div., Savoy. Hazard-ous Waste Research and Information Center. For primary bibliographic entry see Field 5B.

CAUSES OF WETLAND LOSS IN THE COAST-AL CENTRAL GULF OF MEXICO, VOLUME 2: TECHNICAL NARRATIVE,

Louisiana State Univ., Baton Rouge. Center for Wetland Resources. For primary bibliographic entry see Field 4C. W89-02878

CAUSES OF WETLAND LOSS IN THE COAST-AL CENTRAL GULF OF MEXICO. VOLUME 3. APPENDICES.

Louisiana State Univ., Baton Rouge. Coastal Ecology Lab. For primary bibliographic entry see Field 4C.

W89-02879

BIOLOGICAL TREATMENT OF TOXIC IN-DUSTRIAL WASTE, National Environmental Engineering Research Inst., Nagpur (India). Environmental Microbiology

For primary bibliographic entry see Field 5D. W89-02919

TOXICITY OF DEGDN, SYNTHETIC-HC SMOKE COMBUSTION PRODUCTS, SOLVENT YELLOW 33 AND SOLVENT GREEN 3 TO FRESHWATER AQUATIC ORGANISMS, Johns Hopkins Univ., Shady Side, MD. Environmental Sciences Group. D. J. Fisher, D. T. Burton, and R. L. Paulson.

D. J. Fisher, D. T. Burton, and R. L. Paulson. Available from the National Technical Information Service, Springfield, VA 22161, as AD-A188 766. Price codes: A04 in paper copy, A01 in microfiche. Final Report for Phase II, January 1987. 75p, 8 fig. 16 tab, 42 ref, 2 append. Navy Contract N00039-87-C-5301 and Army MIPR85MM5505.

Descriptors: *Water pollution effects, *Toxicity, *Ammunition plants, Organic compounds, Indus-trial wastewater, Heavy metals, Zinc, Lead, Ar-senic, Cadmium, Aluminum, Fish, Invertebrates, Hydrochloric acid, Solvents, Lethal limits, Hex-achlorobenzene, Perchloroethylene, Hexachloroethane, Algae.

The acute toxicities of four munitions compounds to nine freshwater aquatic organisms were determined. The munitions were solvent green 3, and synthetic-HC smoke combustion products which are a complex mixture containing zinc, cadmium, arsenic, lead, aluminum, carbon tetrachloride, perchloroethylene, hexachloroethane, hexachloroebenzene, and hydrochloric acid. Fish exposed to the four materials for 96 h included the fathead minnow, bluegill, channel catfish and rainbow trout. Invertebrates, which were exposed for 48 h, included the water flea, amphipod, midge larva, and the mayfly larva. Growth of the green algae Selenastrum capricornutum was also tested with all the compounds. The toxicity of DEGDN was relatively low to the nine freshwater species tested. Toxicity values ranged from a 5-day EC50 (growth) of 39.1 mg/L for S. capricornutum to a 96 h LC50 of 491.4 mg/L for the fathead minnow. The dissolved components of the synthetic-HC smoke combustion products mixture were very toxic to a number of freshwater species, especially S. capricornutum, rainbow trout, and water flea. A test solution containing only 5.6% of a stock mixture of these components caused both an algistatic and algicidal effect on the alga. The rainbow trout and the water flea had 96 h and 48 h LC50s of 2.2% and 9.3% of the stock solution, respectively. Solvent yellow 33 and solvent green 3 were not toxic to seven of the nine freshwater species when tested at their solubility limits. (Lantz-PTT) The acute toxicities of four munitions compounds

WATER QUALITY ASSESSMENT OF DOD IN-STALLATIONS/FACILITIES IN THE CHESA-

Effects Of Pollution—Group 5C

PEAKE BAY REGION. PHASE III REPORT. VOLUME 1 - SUMMARY.
Tetra Tech, Inc., Arlington, VA.
Available from the National Technical Information Service, Springfield, VA 22161, as AD-A190 073.
Price codes: A06 in paper copy, A01 in microfice. November 1987. 95p, 25 fig. 4 tab, 4 ref, append. Army Corps of Engineers Contract DACA 31-85-C-0168.

Descriptors: *Chesapeake Bay, *Industrial wastewater, *Water pollution effects, *Water pollution sources, *Water quality, Ecological effects, Organic compounds, Pesticides, Hydrocarbons, Heavy metals, Hazardous wastes, Wastewater stor-

This report represents the culmination of a two-year, three-phase effort to determine the relative impact of DoD activities on the water quality and living resources of the Chesaneak Bay. Phase III impact of DoD activities on the water quality and living resources of the Chesapeake Bay. Phase III applied the tested methodology to the remaining 31 installations identified in Phase I as needing more detailed assessment, and summarizes impacts and program recommendations from an installation, regional, and Bay-wide perspective. With the exception of the Naval Surface Weapons Center at Dahlgren, Harry Diamond Labas - Blossom Point, and Aberdeen Proving Ground, the military activities appear to play a minor role in the resional or ties appear to play a minor role in the regional or far-field water quality conditions of Chesapeake ties appear to play a minor role in the regional or far-field water quality conditions of Chesapeake Bay. Areas that represent ongoing problems at the military installations relate primarily to nonpoint or intermittent pollutant sources that are difficult to control. The discharge of toxics from poorly defined point and nonpoint sources (including abandoned waste disposal sites) is potentially the most important issue related to the preservation of water quality on or near the military installations. Certain toxic constituents (e.g., hydrophobic organic compounds such as pesticides, polynuclear aromatic hydrocarbons, and halogenated hydrocarbons and inorganic compounds such as heavy metals) are of special concern due to the tendency to adsorb to sediments and to accumulate in the estuarine sediment bed, where benthic organisms are exposed over long periods of time. (See also W89-02953) (Lantz-PTT)

WATER QUALITY ASSESSMENT OF DOD IN-STALLATIONS/FACILITIES IN THE CHESA-PEAKE BAY REGION. PHASE III REPORT. VOLUME 2 - OVERALL APPROACH, FIND-INGS AND RECOMMENDATIONS.

Tetra Tech, Inc., Arlington, VA.
Available from the National Technical Information
Service, Springfield, VA 22161, as AD-A190 074.
Price codes: A22 in paper copy, A01 in microfiche.
563p. 53 fig. 744 tab, 63 ref, 4 append. Army Corps
of Engineers Contract DAGA 31-85-C-0168.

Descriptors: *Water pollution effects, *Military installations, *Water pollution sources, *Industrial wastewater, *Chesapeake Bay, Water quality, Wastewater treatment, Hazardous wastes, Storm runoff, Nonpoint pollution sources, Organic compounds, Pesticides, Aromatic compounds, Hydrocarbons, Heavy metals, Water pollution prevention.

A two-year, three-phase study was performed to determine the relative impact of DoD activities on the water quality and living resources of the Chesapeake Bay. With the exception of the Naval Surface Weapons Center at Dahlgren, Harry Diamond Labas-Blossom Point, and Aberdeen Provmond Labas-Blossom Point, and Aberdeen Prov-ing Ground, the military activities appear to play a minor role in the regional or far-field water quality conditions of Chesapeake Bay. Areas that repre-sent ongoing concerns at the military installations relate primarily to activities that are difficult to relate primarily to activities that are difficult to control or regulate. They include: stormwater runoff; dispersed, intermittent sources of industrial (toxic) pollutants to sewage treatment systems and/or to storm drains (which are permitted and tested only for conventional pollutants); and aban-doned or inactive hazardous waste disposal sites. The discharge of toxics from poorly defined point and nonpoint sources (including abandoned waste disposal sites) is potentially the most important issue related to the preservation of water quality

on or near the military installations. Certain toxic on or near the military installations. Certain toxic constituents (e.g., hydrophobic organic compounds such as pesticides, polynuclear aromatic hydrocarbons, and halogenated hydrocarbons and inorganic compounds such as heavy metals) are of special concern due to their tendency to adsorb to sediment and to accumulate in the estuarine sediment bed, where benthic organisms are exposed over long periods of time. (See also W89-02953) (Lantz-PTT) W89-02954

U.S. PRODUCTION OF MANUFACTURED GASES: ASSESSMENT OF PAST DISPOSAL PRACTICES, Research Triangle Inst., Research Triangle Park, NC.

NC.
For primary bibliographic entry see Field 5E.
W89-02964

CUMULATIVE IMPACT ASSESSMENT: ISSUES TO CONSIDER IN SELECTING A CUMULATIVE ASSESSMENT METHOD, Argonne National Lab., IL. Energy and Environmental Systems Div. E. A. Stull, M. B. Bain, J. S. Irving, K. E. LaGory, and R. D. Olsen. Available from the National Technical Information Service, Springfield, VA 22161, as DE88-002859. Price codes: A02 in paper copy, A01 in microfiche. Report No. CONF-8708189-1, (1987). 6p, 18 ref. DOE Contract W-31-109-ENG-38.

Descriptors: *Hydroelectric plants, *Water pollution effects, *Environmental effects, Wildlife, Fish, Ecological effects.

Because widespread interest in the subject is new, because widespread interest in the subject is new, there are no standard or generally recognized methods for cumulative impact assessment. A method for assessing the cumulative environmental effects of hydroelectric development should include procedures for (1) evaluating the combined clude procedures for (1) evaluating the combined effects of more than one action; (2) evaluating nonadditive, as well as additive, relationships be-tween projects; (3) assessing the combined indirect effect of projects on fish and wildlife populations, in addition to direct effects on the physical envi-ronment and fish and wildlife habitats; (4) assessing any of the 16 types of impacts to 40 species of fish and wildlife. (Author's abstract) W89-02965

PROBLEMS OF THE TOXICOLOGICAL COM-PATIBILITY OF HYDROGEN PEROXIDE IN DRINKING AND SWIMMING POOL WATER FOR HUMANS FROM THE PHARMACOKIN-ETIC AND BIOCHEMICAL POINTS OF VIEW (PROBLEME DER HUMANTOXIKOLOGIS-CHEN VERTRAGLICHKEIT VON WASSER STOFFPEROXID IN BADE- AND TRINK-WASSER AUS BIOCHEMISCHER UND PHAR-MAKOKINGTISCHER SICHTD

MAKOKINETISCHER SICHT), Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene. H. H. Dieter.

ZWAGAQ, Vol. 21, No. 4, p 133-140, August 1988. 1 fig, 43 ref.

Descriptors: *Toxicity, *Disinfection, *Human pathology, *Public health, *Water treatment, *Drinking water, *Swimming pools, Morbidity, Biochemistry, Enzymes, Hydrogen peroxide.

With regard to the possible application of stabilized hydrogen peroxide as a disinfectant in drinking water and swimming pool water, the experimental and biochemical toxicology of reactive oxygen was examined from different points of (physiological levels; acute and chronic tox-mutagenic and carcinogenic potentials; oxiicity; mutagenic and carcinogenic potentials; oxi-dative damage of membranes; auto-immunomime-tic properties; physiologic protection mechanisms). A recommendation by the Federal Health Office of products that act on the basis of reactive oxygen as drinking and swimming pool water disinfectants will be possible only after the following pharmaco-kinetic and biochemical questions have been eluci-dated: (1) extent and time dependency of the diffu-

sive resorption of hydrogen peroxide through skin and mucous membranes; (2) detoxification of exog-enous hydrogen peroxide by skin and membrane enzymes in erythrocytes and peripheral organs; (3) extent of the formation of oxidative intermediary eatent of the formation of oxidative intermediary and end products from DNA, lipids, carbohydrates and proteins under true exposure conditions; and (4) interindividual and intraindividual variation of the protective physiological enzymes and antioxi-dants. (Author's abstract) W89-03042

AQUATIC MACROPHYTES IN ADIRONDACK (NEW YORK) LAKES: PATTERNS OF SPECIES COMPOSITION IN RELATION TO ENVIRON-MENT.

MENT, Indiana Univ. at Bloomington. Dept. of Biology. S. T. Jackson, and D. F. Charles. Canadian Journal of Botany CJBOAW, Vol. 66, No. 7, p 149-1460, July 1988. 6 fig. 4 tab, 91 refs. NSF Grants DEB 77-03907 and DEB 79-12210.

Descriptors: "Water pollution effects, "Acidic water, "Lakes, "Macrophytes, "Adirondack Mountains, "New York, "Acid rain effects, "Acidication, "Aquatic plants, Species composition, Lentic environment, Hydrogen ion concentration, Chemical properties, Conductivity, Alkalinity, Calcium, Magnesium, Sodium, Detrended correspondence analysis, Correlation analysis, Submerged plants, Emergent plants.

A study of the vegetation of 31 small, dilute, unproductive lakes in the Adirondack Mountains shows that macrophyte species composition is primarily related to variation in pH and associated factors. Objectives of the study were (i) to describe the aquatic macrophyte floras of the lakes, (ii) to assess the chemical and/or other factors responsible for between-lake differences in species composition and richness, and (iii) to evaluate the potential consequences of lake acidification for aquatic macrophyte composition. Among the lakes, surface-water pH ranged from 4.5 to 7.8; conductivity ranged from 11.9 to 58.7 microS/cm. Indirect ordinations of macrophyte presence/absence data were studied using deternded correspondence analysis (DCA). Submersed and floating-leaved taxa were analyzed separately from emergent taxa. Pearson product/moment correlations between each of the first two DCA axes and environmental variables were carried out to determine the ecological factors associated with the variation in vegetation identified by the ordination. Correlations between DCA axis 1 and pH-related factors (pH, alkalinity, Ca, Mg, Na, Al, conductivity, elevation) were strong for both submersed plus floating-leaved and emergent taxa. No significant correlations were found with water color, transparency, or trophic status indicators (total P and chlorophyll a). Between-lake variation in composition of aquatic vegetation in Adirondack lakes follows a pH complex gradient' of significantly interrelated variables. Influences of elevation, morphometry, and A study of the vegetation of 31 small, dilute, unproductive lakes in the Adirondack Mountains vegetation in Adirondack lakes follows a pH 'com-plex gradient' of significantly interrelated varia-bles. Influences of elevation, morphometry, and substrate are secondary. The results indicate that acidification of softwater lakes could be accompa-nied by significant changes in aquatic macrophyte assemblages. (Shidler-PTT) W89-03056

EFFECTS OF OZONE AND ACID RAIN ON WHITE PINE (PINUS STROBUS) SEEDLINGS GROWN IN FIVE SOILS: II. MYCORRHIZAL INFECTION,

Cornell Univ., Ithaca, NY. Dept. of Agronomy. H. F. Stroo, P. B. Reich, A. W. Schoettle, and R.

G. Amundson. Canadian Journal of Botany CJBOAW, Vol. 66, No. 8, p 1510-1516, August 1988. 3 fig, 6 tab, 31

Descriptors: *Acid rain, *Ozone, *Air pollution effects, *Pine Trees, *Soil fungi, Air pollution, Soil types, Simulated rainfall, Roots, Acidity, Hydrogen ion concentration, Plant morphology, Infection, Synergistic effects, Nitrogen.

Mycorrhizal infection of white pine seedlings was measured after 4 months of exposure to simulated acid rain and ozone, applied either alone or in

Group 5C-Effects Of Pollution

combination. Increasing rain acidity consistently combination. Increasing rain acidity consistently reduced the number of mycorrhizal short roots. In general, infection decreased linearly versus rain pH. Plants exposed to simulated rain at pH 3.0 had approximately 20% fewer mycorrhizal roots than plants exposed to pH 5.6 rain. The decrease in the number of mycorrhizal roots was a result of decreases both in the number of short roots available. for infection and in the percentage of roots infect-ed. Ozone had no effect on mycorrhizal infection if ed. Ozone had no effect on mycorrnizal infection in applied 3 alternate days a week at concentrations ranging from 0.02 to 0.14 ppm. However, there were significant changes in infection in plants exposed to ozone for 5 days a week. There was no evidence for an interaction between the two polevidence for an interaction between the two pol-lutants. Percent mycorrhizal infection was highly correlated with seedling nitrogen concentration across all soil types and rain treatments. These observations suggest that increases in available ni-trogen may have been largely responsible for the observed effects of acid rain on mycorrhizae. (See also W89-03058) (Author's abstract) W89-03057

EFFECTS OF OZONE AND ACID RAIN ON WHITE PINE (PINUS STROBUS) SEEDLINGS GROWN IN FIVE SOILS: III. NUTRIENT RE-LATIONS.

Boyce Thompson Inst. for Plant Research, Ithaca, NY.
P. B. Reich, A. W. Schoettle, H. F. Stroo, and R.

F. Amundson. Canadian Journal of Botany CJBOAW, Vol. 66, No. 8, p 1517-1531, August 1988. 10 fig, 5 tab, 29 ref, app end.

Descriptors: *Acid rain, *Ozone, *Pine trees, *Nu-ACCEPTIONS: ACIG TRIN, 'UZONE, 'Pine trees, 'Nutrients, 'Soil types, Forest soils, Simulated rainfall, Litter, Leaching, Soil Chemistry, Plant physiology, Plant growth, Plant tissues, Leaves, Roots, Synergistic effects.

Pollutant effects on nutrient relations of white pine Pollutant effects on nutrient relations of write pine were assessed for potted seedlings grown in forest soils. Ozone treatments consisted of frequent exposure to 0.02, 0.06, 0.10, or 0.14 ppm ozone, while acid-rain treatments consisted of exposure to simulated rain of pH 5.6, 4.0, 3.5, or 3.0. Plants were treated with all combinations of acid-rain and ozone levels, and treatments were administered for ozone ieven, and treatments were administered for 4 months. Acid rain caused significant leaching of Ca, Mg, K, Mn, Zn, and Cd from leaf litter on the soil surface, and soil Mg and K content declined as well. Concentrations in needles of N, P, K, Ca, well. Concentrations in needles of N, P, K, Ca, Mn, Cd, and Cr were significantly increased as a result of acid-rain treatments. In roots, concentrations of N, Mn, Cd, and Cr were significantly elevated as a result of acid rain. Similar increasing but nonsignificant trends were observed for Mg, Zn, and Cu in needles and for P, K, Mg, Ca, and Cu in roots. Despite the increases in all the major nutrients, the nutrient weight proportions of K:N, P:N, Ca:N, and Mg:N generally declined in pine tissue as a result of acid rain. Although these relationships were relatively consistent for pine in all soils, significant differences between soils in response to acid rain were observed for some elements. Ozone had significant effects on K, Ca, and Mn concentrations, and interactions between acid rain and ozone were observed for these three acid rain and ozone were observed for these three elements. The results suggest that the effects of acid rain on tree nutrition may be roughly similar in different soils but that the effects on physiology and growth will be heavily influenced by specific soil properties. (See also W89-03057) (Author's

POTENTIAL IMPACTS OF A SCENARIO OF CO2-INDUCED CLIMATIC CHANGE ON ON-TARIO, CANADA,
Canadian Climate Centre, Downsview (Ontario). For primary bibliographic entry see Field 2A. W89-03063

TEMPORAL RELATIONSHIP OF VIBRIO PARAHAEMOLYTICUS IN PATIENTS AND THE ENVIRONMENT,
Shaughnessy Hospital, Vancouver (British Columbia). Div. of Microbiology.

For primary bibliographic entry see Field 5B. W89-03064

SENSITIVITY OF MEANDER LAKE TO ACID

Systech Engineering, Inc., Lafayette, CA. C. W. Chen, S. A. Gherini, R. Munson, L. Gomez, and C. Donkers.

JOEDDU, Vol. 114, No. 5, p 1200-1216, October 1988. 9 fig, 3 tab, 23 ref.

Descriptors: *Acid rain, *Model studies, *Lakes, *Acid rain, *Minnesota, Alkalinity, Meander Lake, Humic acids, Acidification, Integrated Lake Watershed Acidification Study.

Meander Lake in northeastern Minnesota was classified as 'extremely sensitive' to acid deposition, due to its low alkalinity. The Integrated Lake Watershed Acidification Study model was applied to determine its actual sensitivity. The model was to determine its actual sensitivity. The model was calibrated with observed data and then used to evaluate the response of the lake to various levels of acidic deposition. At the current deposition rate of 12 kg/ha/yr sulfate, the lake can maintain an alkalinity of 70 micro eq/1 and a pH of 6.2 indefinitely. A 50% increase in sulfate deposition would nitely. A 50% increase in sulfate deposition would decrease the alkalinity by 13 micro eq/l and the pH from 6.2 to 6.1 in 20 years. A 50% decrease in sulfate deposition would raise the alkalinity by 12 micro eq/l and the pH from 6.2 to 6.3. Acidic deposition is largely neutralized by alkalinity from mineral weathering in thick mineral deposits surrounding the lakeshore. Low alkalinity is not a sufficient condition for a lake to be sensitive to acidification. Furthermore, the alkalinity of many Minnesota lakes may have been underestimated by Minnesota lakes may have been underestimated by Gran titration due to their high concentrations of organic acids. (Author's abstract) w89-03110

CONTAMINATED AQUIFERS ARE A FOR-GOTTEN COMPONENT OF THE GLOBAL N2O BUDGET, Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Isotope Research. For primary bibliographic entry see Field 5B. W89-03121

RECENT ACIDIFICATION OF A LARGE SCOTTISH LOCH LOCATED PARTLY WITHIN A NATIONAL NATURE RESERVE AND SITE OF SPECIAL SCIENTIFIC INTER-EST,

University Coll., London (England). Dept. of Ge-

ograpny. R. J. Flower, R. W. Battarbee, J. Natkanski, B. Rippey, and P. G. Appleby. Journal of Applied Ecology JAPEAI, Vol. 25, No. 2, p 715-724, August 1988. 5 fig. 2 tab, 32 ref.

Descriptors: *Loch Laidon, *Lakes, *Acid rain, *Air pollution, *Water pollution, *Lead, *Heavy metals, *Scotland, Zinc, Soot, Diatoms, Nature reserve, Isotope studies, Lead studies, Water pollution, Water pollution sources, Ecology, Paleolim-

The recent acidification history of Loch Laidon is reconstructed from diatom analysis of a Pb210-dated sediment core and the effect of atmospheric dated sediment core and the effect of atmospheric pollution is assessed from carbonaceous particle ('soot') and trace metal concentrations in the sediment. Diatom analysis revealed changes in species composition, with the planktonic diatom Cyclotella kuetzingiana common until the mid-nineteenth century and Brachysira vitrea declining in the 1940s and being replaced by acidophilous species, notably Tabellaria flocculosa and Eunotia veneris. Lead, zinc and 'soot' concentrations were highest in sediment deposited during this century, with the trace metals increasing from about 1850 AD and 'soot' from about 1930. Loch Laidon has become more acid and has been affected by lead and zinc more acid and has been affected by lead and zinc contamination since the mid-nineteenth century. Soot contamination of the sediment probably re-flects the national increase in oil combustion since the 1930s. (Author's abstract) W89-03125

INDEX OF WATER QUALITY PERMITTING ENVIRONMENTAL FOLLOW-UP AND AS-SESSMENT OF LOCAL IMPACTS (INDICE DE QUALITE DE L'EAU PERMETTANT LE SUIVI ENVIRONNEMENTAL ET LA MESURE DES IMPACTS LOCAUX),

Institut National de la Recherche Scientifique, Sainte-Foy (Quebec). D. A. Cluis, Y. Lefebvre, and C. Laberge.

Canadian Journal of Civil Engineering CJCEB8, Vol. 15, No. 3, p 323-333, June 1988. 7 fig, 5 tab, 13 ref. English summary.

Descriptors: *Water quality, *Rivers, Effluents, Mathematical models, Pollution index, Sampling, Monitoring, Quebec.

A new local index for the evaluation of effluent A new local index for the evaluation of effluent impacts on a receiving water body is proposed; this index makes use of linear weighting functions calculated on the differences between the upstream and downstream measurements of parameters which are affected by specific effluents. The procedure ranks each parameter value with regard to the maximum and minimum values observed before and after the outfall. For this reason, the resulting values are very sensitive to local perturbations. Linear characteristics of the index structure allow simple conversion from local databases to broader ones, thus allowing the measure of the cumulative impacts downstream. This index also allows the comparative rating of the water quality through time, if the effluent is subjected to some intervention. As such, it can also contribute to the environmental follow-up of a sanitation program. If a
hydrological basin is equipped with a monitoring
network, the proposed methodology permits the
use of the resulting global database to quantily
relative impacts of different effluents, and thus
allows a hierarchical classification of the effluents
to be treated according to priority. The proposed
impact index has been tested with water quality
data obtained during one year on a bi-weekly basis
upstream and downstream from the untreated
sewage outfall of Sainte-Anne de la Perade (Portneuf, Province of Ouebeo). The computed index as tion. As such, it can also contribute to the environsewage outlant of Sante-Anne de la Ferade (Fort-neuf, Province of Quebec). The computed index as a whole is more sensitive to changes in water quality than individual parameters. External fac-tors such as river flow and temperature do not significantly affect the values of the index. (Author's abstract) W89-03131

PREDICTING THE EFFECTS OF A PESTICIDE RELEASE TO THE RHINE RIVER,

Iowa Univ., Iowa City. Dept. of Civil and Environmental Engineering.

D. J. Mossman, J. L. Schnoor, and W. Stumm.

Journal - Water Pollution Control Federation JWPFA5, Vol. 60, No. 10, p 1806-1812, October 1988. 11 fig, 4 tab, 16 ref.

Descriptors: *Pesticides, *Rhine River, *Path of pollutants, *Rivers, *Water pollution effects, *Mathematical models, *Organophosphorus pesticides, Model studies, Environmental effects.

A 1-dimensional unsteady contaminant transport model was applied to the Sandoz Chemical Com-pany spill of November, 1986, into the Rhine River. The model is unconditionally stable and included the chemical exchange from the water column to a fixed bed and kinetic degradation and transformation reactions for organic chemicals. Nine chemicals were calibrated to field data; the predominant chemicals in the spill were organo-phosphate pesticides. Model output provided eco-system exposure information and estimates of sedi-ment contamination. (Author's abstract) W89-03159

INTERSTITIAL WATER QUALITY OF LAKE TROUT SPAWNING HABITAT,

National Water Research Inst., Burlington (Ontario).

P. G. Sly.

Journal of Great Lakes Research JGLRDE, Vol. 14, No. 3, p 301-315, 1988. 6 fig, 7 tab, 18 ref.

Effects Of Pollution—Group 5C

Descriptors: *Interstitial water, *Spawning, *Fish management, *Trout, *Silting, *Lake sediments, Impaired water quality, Aquatic habitats, Substrates, Lakes, Great Lakes, Oxygen requirements, Fish populations.

Coarse substrates used by spawning lake trout may be degraded when fine sediment fills inter-particu-late space, and by the breakdown of organic matter late space, and by the bleakown to organic matter trapped within the substrate. Comparative sub-strate data were obtained to show how interstitial conditions reflect habitat degradation, and the range of measured values associated with some key parameters. Although some spawning habitats are clearly degraded, the extent to which this influence parameters. Although some spawning habitats are clearly degraded, the extent to which this influence effects reproductive success remains uncertain. Small dialysis chambers were placed in cobble-gravel substrates, at sites used by spawning lake trout. These were filled with nitrogen-purged distilled water and were allowed to equilibrate with substrate water at depths of about 4-8 cm below the sediment surface. Open boxes of artificial substrate (0.25 sq m) were placed flush with this surface to collect bedload and deposited fines. Recoveries were made at 1-week to 2-week intervals throughout the fall. In two Algonquin lakes where lake trout reproduction is successful, dissolved oxygen concentrations were mostly > 5 mg/L, and nonionized ammonia was negligible. At sites in eastern Lake Ontario, there were great differences in water quality, depending upon proximity to weed beds and local wind/wave conditions. Low DO (< 0.5 mg/L) and relatively high non-ionized ammonia (> 30 micrograms/L) were associated with degradation of millfoil and, to a lesser extent, Cladophora. In the Finger Lakes, substrate quality was much lower in Seneca Lake (hatchery supported lake trout stock) Depression of dissolved Oxygen was much lower in Seneca Lake (hatchery sup-ported lake trout stock) than in Keuka Lake (wild lake trout stock). Depression of dissolved oxygen followed periods of high particulate flux and this stress was greatest after lake trout spawning, and when rates of depradation are still relatively high. (Author's abstract) W89-03172

IN VITRO GENOTOXICITY OF CHLORINAT-ED DRINKING WATER PROCESSED FROM HUMUS-RICH SURFACE WATER,

HUMUS-RICH SURFACE WATER, National Public Health Inst., Kuopio (Finland). Dept. of Environmental Hygiene and Toxicology. A. Liimatainen, and T. Grumm. Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 5, p 712-718, November 1988. 15 ref, 3 tab.

Descriptors: *Chlorination, *Mutagenicity, *Drinking water, *Decomposing organic matter, *Water treatment, *Genotoxicity, Sublethal effects, Toxicity, Finland.

fects, Toxicity, Finland.

Finnish drinking waters, processed from humusrich surface water using chlorine disinfection, have been found to be highly mutagenic in the Ames test. The highest activities have been found in the acidic, non-volatile fraction of the water concentrates using tester train TA100 without metabolic activation by \$9 mix. The mutagenicities have varied between \$00 and 14,000 induced revertants per liter. These figures are one to two magnitudes higher than those reported elsewhere. Five Finnish drinking water samples were studied for their potency to exert genotoxic effects, sister chromatid exchanges and chromosome aberrations, in mammalian cells in vitro (human peripheral lymphocytes and Chromosome aberrations in the hamster cell assay. Doses higher than 200 ml equivalents of water were cytotoxic. On the basis of these results, the use of humus-rich surface water as raw water together with chlorine disinfection, produces potent genotoxic substances, which represent a carcinogenic risk to man. (VerNooy-PTT)

ACUTE TOXICITY OF MALATHION, TETRA-BROMOBISPHENOL-A, AND TRIBUTYLTIN CHLORIDE TO MYSIDS (MYSIDOPSIS BAHIA) OF THREE AGES, Environmental Protection Agency, Gulf Breeze,

FL. Gulf Breeze Environmental Research Lab. L. R. Goodman, G. M. Cripe, P. H. Moody, and D. G. Halsell.

D. G. Halsell.

Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 5, p 746-753, November 1988. 2 tab, 26 ref.

Descriptors: *Toxicity, *Malathion, *Insecticides, *Phenols, *Tin, *Mysids, *Water pollution effects, Lethal limit, Bioassay, Median tolerance limit, Es-

Little published comparative information is available on the affect of age on the acute sensitivity of Mysidopsis bahia to toxic compounds. The purpose of this study was to obtain information on the relative sensitivity of M. bahia of different ages and to obtain toxicity data on malathion (\$-(1,2-dicarbethoxyethyl)-O.O-dimethyldithiophosphate, tetrabromobisphenol-A (2,2-bis(3,5-dibromo-4-hydroxyphenyl)propane, or TBBPA), and tributyl-in chloride (TBTC). Mysids of 3 ages (< or = 1 day, 4-5 days or 9-10 days) were exposed in the same aquaria during flow-through 96-h acute tests with each of the three test compounds. TBTC was the most toxic, with 96-h LC20 values of 1.1 micrograms/L for 1-d-old, 2.0 micrograms/L for 1-d-old, and 2.2 micrograms/L for 10-d-olds. Sensitivities of the three age groups of mysids to malathion were the same statistically at 3.0 for 1-d-olds, 3.1 for 5-d-olds and 2.6 for 10-d-olds, TBBPA was the least toxic of the compounds, with 96-h LC20 values of 860 ug/L for 1-d-olds, 1100 micrograms/L for 5-d-olds, and 1200 micrograms/L for 10-d-olds. Tb ada demonstrate that age was not a large factor in the acute sensitivity of juvenie M babis to the compounds. micrograms/L for 10-0-0ios. The data demonstration that age was not a large factor in the acute sensitivity of juvenile M. bahia to the compounds tested. (VerNooy-PTT) W89-03203

SENSITIVITY OF BRANCHIAL MUCUS TO CRUDE OIL TOXICITY IN A FRESHWATER FISH, COLISA FASCIATUS, Bihar Univ., Muzaffarpur (India). Dept. of Zoolo-

M. S. Prasad.

M. S. Frasau.

Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 5, p 754-758, November 1988. 11 ref, 1 fig.

Descriptors: *Oil spills, *Toxicity, *Fish, *Crude oil, *Oil pollution, Water pollution effects, Fish physiology, Histology, Bioassay, Lethal limit, Gills.

Mucous cell hyperplasia in fish is a general phe-nomenon associated with crude oil toxicity. This investigation has been undertaken to provide a better understanding of the pathogenic effects of crude oil on the branchial mucus of a freshwater fish, Colisa fasciatus. The toxicity assessment is based on the histochemical observations of mucous based on the histochemical observations of mucous cells present in the epithelia of gill rakers and filaments. Groups of 6 fish were exposed to 200, 500, 700, 1000 (lethal) or 1500 ppm crude oil solutions for 2-24 hours. Histochemical observations of mucous cells were performed on the parafin sections by using Periodic acid-Schiff (PAS), alcian blue (AB), PAS-AB combinations, toluidine blue (TB) and Mallory's triple stain. In 200 ppm, after exposing the fish for 15 days or more, almost no departures in the staining reactions occurs from no departures in the staining reactions occurs from those of the control fishes. In 500 ppm of crude oil solutions, the mucous cells react strongly with AB. After 96 h, the cells gradually enlarge in dimension and secrete copious amounts of mucus. At 1000 ppm, lesions in the gill epithelia and curling of the ppm, lesions in the gill epithelia and curling of the secondary lamellae are marked. In 1500 ppm after 24 h, the epithelia of the gill rakers as well as the lamellae have lost their color in PAS and/or AB. The mucous cells show a sharp decline in their density and dimension. Results obtained here suggest that the mucous cells try to attenuate the stress by increasing their density and secretory products in sublethal concentrations but this physical coloried editatement energy tensions when the stress coloried editatement energy tensions. ological adjustment seems transient when the stress is further increased. (VerNooy-PTT) W89-03204

EFFECTS OF WATER SOLUBLE CRUDE OIL FRACTIONS ON CIRRAL BEAT FREQUENCY IN BALANUS BALANOIDES,

Kiel Univ. (Germany, F.R.). Inst. fuer Meeres-A. Ponat.

Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 5, p 759-764, November 1988. 2 fig, 13 ref.

Descriptors: *Oil spills, *Toxicity, *Barnacles, *Crude oil, *Oil pollution, *Water pollution effects, Median tolerance limit, Bioassay, Metabolism, Sublethal effects.

lism, Sublethal effects.

The influence of water-soluble fractions of crude oil from Venezuela (Cabimas) and Saudi Arabia (Arabian-light) on cirral activity of Balanus balanoides was studied. Cirral beat reflects the general metabolic level of the barnacle and may be a suitable indicator for sublethal pollution effects on the organism. Barnacles were exposed to a mixture of 1.5 mL crude oil in 1.5 L sea water, in 1 L decanted off from the insoluble components of the oil. Both cirral beat and recovery time were influenced by the water-soluble fractions of crude oil. Effects differed according to oil type. The water-soluble fraction of Cabimas oil did not change the mean value of cirral activity of the balanids, but some animals became more active and others diminished their activity. After 3 h in clean sea water most of the balanids showed again normal cirral activity. After observed. By contrast Arabian-light oil reduced cirral activity of the balanids. One day after contamination recovery was hardly recognizable. After a recovery time of 5 days beat frequency was the same as before contamination. The experiments indicate that cirral beat frequency and consequently food intake are inhibited by water-soluble crude oil components. (VerNooy-PTT) W89-03205

EFFECT OF TEMPERATURE ON THE CHRONIC TOXICITY OF HYDROTHOL191 TO THE FATHEAD MINNOW (PIMEPHALES PROMELAS),

PROMELAS),
Florida Univ., Gainesville. Dept. of Environmental
Engineering Sciences.
A. E. Keller, R. J. Dutton, and T. L. Crisman.
Bulletin of Environmental Contamination and
Toxicology BECTA6, Vol. 41, No. 5, p 770-775,
November 1988. 1 fig. 3 tab, 8 ref. Florida Dept. of
Environmental Regulation Grant WM152.

Descriptors: *Water pollution effects, *Tempera-ture effects, *Toxicity, *Minnow, *Herbicides, *Thermal stress, Growth, Survival, Bioassays.

*Thermal stress, Growth, Survival, Bioassays.

Hydrothol-191 is the alkylamine salt of the herbicide Endothall (7-oxabicyclo(2,2,1)heptane-2,3-dicarboxylic acid). It is used extensively in Florida to eliminate macrophyte infestations in canals and lakes. In order to provide chronic toxicity data on this compound, fathead minnows were used in the EPA's subchronic toxicity test. The effects of temperature on Hydrothol toxicity was also studied. Groups of 10 fathead minnow were exposed in water at either 15 C or 25 C. The 96-h LC50 increased from 393 micrograms/L at 15 C to 468 micro/L at 25 C. The 7-d LC50 increased from 233 micro/L at 15 C to 304 micro/L at 25 C. These results suggest that the fish were stressed by the lower test temperatures even though differences in percent survival at the two temperatures were not statistically significant. The Chronic Value (ChV), roughly equivalent to the maximum allowable toxicant concentration, was 81 micro/L Hydrothol at 25 C. Chronic toxicity values for survival and growth of fathead minnows were two (at 15 C) to six (at 25 C) times lower than those determined from acute tests. (VerNooy-PTT) W89-03206

EFFECT OF ASSAM CRUDE ON PHOTOSYN-THESIS AND ASSOCIATED ELECTRON TRANSPORT SYSTEM IN ANABAENA DO-

North-Eastern Hill Univ., Shillong (India). Dept.

A. K. Singh, and J. P. Gaur.
Bulletin of Environmental Contamination and
Toxicology BECTA6, Vol. 41, No. 5, p 776-780,

Group 5C—Effects Of Pollution

November 1988. 2 tab, 18 ref.

Descriptors: *Water pollution effects, *Crude oil, *Oil pollution, *Anabaena, *Cyanophyta, *Algae, *Toxicity, Photosynthesis, Metabolism, Electron transport, Biochemical tests.

transport, Biochemical tests.

Petroleum oils have been found to inhibit photosynthesis (light-induced O2 evolution or 14C incorporation) of laboratory cultures as well as natural phytoplankton populations. The influence of Assam crude on the photosynthetic O2 evolution as well as upon its electron transport system in Anabaena doliolum, a heterocystous blue-green alga (cyanobacterium), has been examined. One part of sterilized Assam crude was stirred with 20 parts of sterilized culture medium, and the aqueous phase containing water-soluble fraction was separated. This solution was found to have 12.7 mg/L oil. The alga was exposed to 0-10 mg/L of oil. Though lower concentrations stimulated photosynthetic O2 evolution, higher concentrations were always inhibitory. The study showed that the test oil primarily acted upon photosystem II of the photosynthetic electron transport. (VerNooy-PTT)

DIFLUBENZURON APPLICATION TO CITRUS AND ITS IMPACT ON INVERTE-BRATES IN AN ADJACENT POND, Central Florida Research and Education Center,

Sanford, FL.
A. Ali, H. N. Nigg, J. H. Stamper, M. L. Kok-Yokomi, and M. Weaver.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 5, p 781-790, November 1988. 1 fig. 3 tab, 12 ref.

Descriptors: *Insecticides, *Aquatic animals, *Pesticides, *Invertebrates, *Diffubenzuron, *Water pollution effects, Citrus fruits, Ponds, Population density.

In the past two decades, the insect growth regula-tor (IGR), diflubenzuron, has shown excellent ac-tivity against economically important terrestrial in-sects and is also highly effective against aquatic dipterans, such as Chaoboridae, Chironomidae, and Culicidae, at field rates ranging from 2.5 to 16 ppb. Diflubenzuron, when applied directly to water for control of aquatic dipterans, simulta-neously reduces some invertebrate populations for short periods of time. The purpose of this study was to assess adverse effects on invertebrate popu-lations in a pond in Florida located amid citrus lations in a pond in Florida located amid citrus trees and receiving air-drifted diflubenzuron from surrounding citrus areas commercially treated for the control of the citrus rust mite. No apparent adverse effects of diflubenzuron on zooplankton adverse effects of diflubenzuron on zooplankton and benthic invertebrates were seen in an exposed pond located amid the treatment area. The largest residue of 197 ppt of diflubenzuron in the exposed pond occurred 2-days post-application, with levels returning to trace amounts (< 27 ppt) by day 14 post-application. (VerNooy-PTT) W89-03208

ACUTE TOXICITY OF BINARY MIXTURES OF FIVE CATIONS (CU(2+), CD(2+), ZN(2+), MG(2+), AND K(+)) TO THE FRESHWATER AMPHIPOD GAMMARUS LACUSTRIS (SARS): ALTERNATIVE DESCRIPTIVE MODELS, Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst. B. G. E. de March.

Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 4, p 625-633, April 1988. 2 fig, 3 tab, 38 ref.

Descriptors: *Toxicity, *Heavy metals, *Water pollution effects, *Amphipods, Aquatic populations, Probit analysis, Synergistic effects, Bioassy, Population exposure, Model studies, Chemical properties, Copper, Cadmium, Zinc, Magnesium, Potassium, Ions, Cations.

The combined results of 10 acute toxicity experi ments, each testing the joint toxicity of two of the ions Cu(2+), Cd(2+), Zn(2+), Mg(2+), and K(+), were examined in terms of different re-

sponse surface models that could be used to make decisions about limiting toxic components in mixtures. The classical probit model for simple similar action described experimental results satisfactorily with a model R squared of 0.282; equations in which probit (p) was described directly by a linear combination of toxicant concentrations fit data sigcombination of toxicant concentrations fit data significantly better, with an R squared of 0.527. Equations with more complex linear terms and appropriate weighting factors applied to the residual sums of squares yielded R squared values up to 0.931. Predicted LC50 values were midrange compared with published values. Based on the linear description of the probit response, K or Mg in combination with either of Cu, Cd, or Zn had additive effects, the combinations Cu and Cd, Cu and Zn, and Cd and Zn had more-than-additive effects, and Mg and K had less-than-additive effects. The relationships between the response surfaces, other described modes of joint action, the toxic units model, and mixture toxicity indices are toxic units model, and mixture toxicity indices are discussed. (Author's abstract) W89-03212

EFFECT OF PH ON SPECIATION AND TOXICITY OF ALUMINUM TO RAINBOW TROUT (SALMO GAIRDNERI),
Alberta Environment, Edmonton. Standards and

Approvals Div. S. Ramamoorthy.

S. Kamamoorthy. Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 4, p 634-642, April 1988. 4 fig, 3 tab, 25 ref.

Descriptors: *Hydrogen ion concentration, *Toxicity, *Acid rain effects, *Water pollution effects, *Fish populations, *Trout, *Aluminum, Chemical properties, Heavy metals, Water treatment, Flocculation, Alum sludge, Population exposure, Mortality, Stream biota, Lethal limit, Sludge.

Alum (aluminum sulfate) is used in many water Alum (aluminum sulfate) is used in many water treatment plants as a flocculant. The resultant settled floc (called alum sludge) may be discharged into receiving waters. The effect of pH on the speciation of released aluminum (AI) from fresh sludge and AI uptake and toxicity to fish in river water in the presence of abiotic substrates enclosed water in the presence of adolos substrates enclosed in dialysis sacs is reported. Freshly precipitated alum sludge holds Al effectively within a wide range of pH (4.50-10.0); abiotic substrates compete with the biota as represented by fish for Al. Fish mortainues observed could be due to colloidal particles and acid- and Al-induced stress at pH 4.50, to colloidal particles at pH 6.00, and to high alkalinity at pH 10.0. At pH 7-9, Al in water, present essentially as filterable nonexchangeable Al (FNEX-Al), was not lethal to fish. (Author's abstract) W89-03213 mortalities observed could be due to colloidal par-

GROWTH, FECUNDITY, AND ENERGY STORES OF WHITE SUCKER (CATOSTOMUS COMMERSONI) FROM LAKES CONTAINING CUMMERSONI) FRUM LAKES CONTAINING ELEVATED LEVELS OF COPPER AND ZINC, Waterloo Univ. (Ontario). Dept. of Biology. K. R. Munkittrick, and D. G. Dixon. Canadian Journal of Fisheries and Aquatic Sci-ences CJFSDX, Vol. 45, No. 8, p 1355-1365, August 1988. 2 fig. 8 tab, 64 ref.

Descriptors: *Water pollution effects, *Zinc, *Copper, *Heavy metals, *Fish populations, *Sucker, *Fertility, Metabolism, Fish physiology, Tissue analysis, Nutrition, Population exposure, Growth, Fish behavior, Water pollution, Lakes,

White sucker (Catostomus commersoni) were colwhite sucker (Catostomus commersom) were col-lected from lakes with elevated levels of both copper (13-15 micrograms/L) and zinc (209-253 micrograms/L) and from control lakes. In all cases the fish reached maturity between 4 and 6 yr of the instruction age there were and 6 yr of age, and until 6 yr of age there were and ifferences in length or weight of fish collected from control and contaminated lakes. After this age, fish from contaminated sites were significantly smaller and shorter than those from control sites. In addition, female sucker from contaminated lakes failed to exhibit significant increases in either length or weight after the age of maturity. The fish from contaminated lakes also exhibited decreases in egg

size and fecundity, no significant increases in fe-cundity with age, and an increased incidence of spawning failure. The failure of female fish to spawning failure. The failure of female fish to grow significantly after maturity, and the de-creased energetic commitment to reproduction, suggests that the food base in the contaminated lakes was limiting the performance of the female sucker. These fish exhibited decreased muscle lipid stores, decreased serum lipid levels during the postspawning period, and an apparent decrease in visceral lipid stores during the autumn. There was visceral input stores during the autumn. There was no effect of collection site on body stores of liver glycogen, liver lipids, serum triglycerides, or total serum cholesterol. It is known that several major food groups were missing from the sediments of contaminated lakes and that sediments under water deeper than 5 m may be incapable of supporting macroinvertebrates. Most of the alterations in macroinvertebrates. Most of the atterations in sucker growth and reproduction appear to be relat-ed to nutritional deficiencies as a result of the chronic effects of elevated sediment metals on the food base of the sucker. (Author's abstract) W80_03225

LONG-TERM SUBLETHAL ACID EXPOSURE IN RAINBOW TROUT (SALMO GAIRDNERD) IN SOFT WATER: EFFECTS ON ION EX-CHANGES AND BLOOD CHEMISTRY,

McMaster Univ., Hamilton (Ontario), Dept. of Bi-

Ology.

C. Audet, R. S. Munger, and C. M. Wood.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 8, p 1387-1398,
August 1988. 5 fig, 1 tab, 64 ref.

Descriptors: *Hydrogen ion concentration, *Trout, *Sublethal effects, *Acid rain effects, *Fish physiology, *Population exposure, *Biochemistry, Fluctuations, Sodium, Acids, Chlorides, Calcium, Potassium, Acidic water.

Long-term sublethal acid exposure (3 mo, pH 4.8) in adult rainbow trout (Salmo gairdneri) acclimated to artificial soft water (Ca(2+) = 50, Na(+) = 50, Cl(-) = 100 microeq/L) caused transient net losses of Na(+) and Cl(-). Net flux rates of both ions were returned to control levels after 30-52 d ions were returned to control levels after 30-52 d of acid exposure through a new equilibrium between unidirectional influx and efflux, where both were lower than control rates. K(+) balance remained negative and Ca(2+) balance at zero throughout the exposure. No changes in net acidic equivalent flux occurred, indicating the absence of acid-base disturbance, but ammonia excretion increased over time. Muscle K(+), Na(+), and Cl(-) fell and Ca(2+) increased. Plasma Na(+), Cl(-), and compositive decreased, white balance proteins. reir and Ca(2+) increased, while plasma protein, glucose, and blood hemoglobin increased during, glucose, and blood hemoglobin increased during the first few weeks of acid exposure. Plasma K(+) and Ca(2+) did not change. General stabilization of plasma parameters occurred in concert with the stabilization of Na(+) and Cl(-) flux rates, but no recovery to control levels was observed for any of them. It is concluded that despite this stabilization at a new steady state, rainbow trout were physio-logically affected in a deleterious manner by chronic sublethal acid exposure in soft water. (Author's abstract) W89-03226

COPPER INTOXICATION IN CHINOOK SALMON (ONCORHYNCHUS TSHAWYSTS-CHA) INDUCED BY NATURAL SPRINGWATER: EFFECTS ON GILL NA(+), K(+)-ATPASE, AND PLASMA GLUCOSE, National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.

B. R. Beckman, and W. S. Zaugg. Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 8, p 1430-1435, August 1988. 3 fig., 1 tab, 27 ref.

Descriptors: *Salmon, *Toxicity, *Copper, *Water pollution effects, Population exposure, Fish popu-lations, Fish physiology, Sodium, Potassium, En-zymes, Heavy metals, Smolt, Spring water.

Chinook salmon (Oncorhynchus tshawytscha) parr and smolts were exposed to natural springwater with an elevated copper concentration. Gill

Effects Of Pollution—Group 5C

Na(+), Na(+), K(+)-ATPase activity in parr was unaffected by 18 h of exposure, but significant inhibition was found in smolts. Under the same exposure conditions, significant increases in hematocrit and plasma glucose were found in both parr and smolts. The results suggest that only the tocrit and plasma glucose were found in both parr and smolts. The results suggest that only the Na(+), K(+)-ATPase enzyme associated with chloride cells in the gill of smo 's susceptible to inhibition by copper, thus explaining the lack of enzyme inhibition found in parr. (Author's abstract) W89-03228

INFLUENCE OF NUTRIENT ENRICHMENT AND LIGHT AVAILABILITY ON THE ABUN-DANCE OF AQUATIC MACROPHYTES IN FLORIDA STREAMS,

Florida Univ., Gainesville. Dept. of Fisheries and

riorida Univ., Gamesville. Dept. of Fisheries and Aquaculture. D. E. Canfield, and M. V. Hoyer. Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 8, p 1467-1472, August 1988. 5 tab, 22 ref.

Descriptors: *Stream biota, *Macrophytes, *Enrichment, *Shading, *Water polution effects, *Eutrophication, *Water pollution control, *Florida, *Nutrients, Riparian vegetation, Ecosystems, Mathematical studies, Statistical analysis, Biomass.

A survey of 17 Florida streams was conducted between October 1984 and August 1986 to determine if the abundance of macrophytes was related to nutrient enrichment and if nutrient removal could alleviate problems. Macrophyte standing crops were not correlated with in-stream total phosphorus or total nitrogen concentrations. Aquatic macrophytes contained less than 2% of the annual nutrient discharge in nearly all streams. Nutrients are, therefore, not considered to be the the annual nutrient dischage in learly at streams. Nutrients are, therefore, not considered to be the primary factor regulating the abundance of aquatic macrophytes in most Florida streams. Shading by riparian vegetation seems to be the dominant factor controlling the location and abundance of aquatic macrophytes. Statistical analyses indicated that the potential, sucrease, and maximum studing crop of macrophytes. Statistical analyses indicated that the potential average and maximum standing crop of aquatic macrophytes in the sampled streams could be estimated by the equations log (SC(avg)) = 1.06 - 0.026 (%C), R squared = 0.93; log (SC(max)) = 1.54 - 0.014 (%C), R squared = 0.94, where SC(avg) and SC(max) are the average and maximum standing crop of aquatic macrophytes (kilograms fresh weight per sourar metry) resnectively. grams fresh weight per square metry presentively, and %C is the percent canopy coverage by riparian vegetation. It is concluded that nutrient removal offers little benefit for macrophyte control in these streams. (Author's abstract) W89-03231

COMPARISON OF PHOSPHORUS DYNAMICS IN TWO OKLAHOMA RESERVOIRS AND A NATURAL LAKE VARYING IN ABIOGENIC TURBIDITY,

Kent State Univ., OH. Dept. of Biological Sci-

For primary bibliographic entry see Field 2H. W89-03232

PHYSIOLOGICAL DISTURBANCES IN FISH LIVING IN COASTAL WATER POLLUTED WITH BLEACHED KRAFT PULP MILL EF-Goeteborg Univ. (Sweden). Dept. of Zoophysio-

logy. T. Andersson, L. Forlin, J. Hardig, and A.

Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 9, p 1525-1536, September 1988. 9 fig, 3 tab, 53 ref.

Descriptors: *Water pollution effects, *Population exposure, *Toxicity, *Pulp and paper industry, *Kraft mills, *Pulp wastes, *Coastal waters, *Bleaching wastes, *Fish physiology, *Morbidty, Water pollution, Metabolism, Effluents, Enzymes, Paperb.

An extensive trial to examine physiological and biochemical changes in perch (Perca fluviatilis) inhabiting coastal waters polluted by bleached

kraft mill effluents (BKME) has been carried out. The investigations were performed at four different times of year. Fish from a reference site and from sampling sites 2, 45, 8, and 10 km from the discharge point were examined. Profound effects of BKME on several fundamental biochemical and physiological functions were shown. Typical symptoms in perch from the polluted areas were reduced gonad growth, enlarged liver, and very strong induction of certain cytochrome -450-dependent enzyme activities in the liver. Elevated levels of ascorbic acid in liver tissue and abnormal carbohydrate metabolism reflect the effluent's ability to cause metabolic disorders. Marked effects on the white blood cell pattern indicate a demand for oxygen by certain tissues was increased and that ity to cause metabolic disorders. Marked effects on the white blood cell pattern indicate a demand for oxygen by certain tissues was increased and that gill function was impaired, respectively. The toxic effects were most pronounced in fish living up to 4.5 km from the discharge point, but some disturb-ances (e.g. cytochrome P-450 induction, reduced gonad size, and hematological alterations) were observed in fish caught as far as 8-10 km from the kraft bleach plant. (Author's abstract) W89-03234

EFFECTS OF ALUMINUM AND LOW PH ON NET ION FLUXES AND ION BALANCE IN THE BROOK TROUT (SALVELINUS FONTIN-

ALIS), McMaster Univ., Hamilton (Ontario). Dept. of Bi-

ology. C. E. Booth, D. G. McDonald, B. P. Simons, and C. M. Wood.

Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 9, p 1563-1574, September 1988. 7 fig. 2 tab, 46 ref. Electric Power research Institute Contract RP-2346-01.

Descriptors: *Aluminum, *Acidic water, *Trout, *Acid rain effects, *Hydrogen ion concentration, *Water pollution effects, Metabolism, Fish physiology, Morbidity, Mortality, Population exposure, Bioaccumulation, Cations, Calcium, Sodium,

Adult brook trout (Salvelinus fontinalis) were ex-Adult brook trout (Salvelinus fontinalis) were exposed for up to 11 d to one of a matrix of 18 Al, low pH, and Ca(2+) combinations, chosen as representative of acidified softwater environments in the wild. Reduction in water pH led to pH-dependent net losses of Na(+) and Cl(-) exacerbated by the presence of Al in the water and reduced by elevating Ca(2+). Any animal losing more than 4% of its total body Na(+) over the first 24 h of Al exposure had a greater than 30°Cs. likelihood of Al exposure had a greater than 90% likelihood of eventual mortality. Na(+) losses arose from inhibition of influx and stimulation of efflux. The inhibition or influx and sumulation of efflux. The innon-tion was persistent and pH-dependent. Addition of Al to acidified water had a slight further inhibitory effect on Na(+) influx and a large stimulatory effect on efflux. The latter was dependent on Al concentration, was the main cause of initial ion losses and mortality, and declined with time in surviving animals. All Al-exposed fish accumulated Al on their gills, but this was apparently mainly surface or subsurface bound, since no internal Al (plasma or liver) could be detected. Nonsurviving fish had substantially higher gill Al levels than survivors. (See W89-03236 thru W89-03243) (Author's abstract) W89-03235

BLOOD GASES, ACID-BASE STATUS, IONS, AND HEMATOLOGY IN ADULT BROOK TROUT (SALVELINUS FONTINALIS) UNDER ACID/ALUMINUM EXPOSURE, McMaster Univ., Hamilton (Ontario). Dept. of Bi-

ology.
C. M. Wood, R. C. Playle, B. P. Simons, G. G.
Goss, and D. G. McDonald.

Goss, and D. G. McDonald. Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 9, p 1575-1586, September 1988. 9 fig. 2 tab, 56 ref. Electric Power Research Institute Contract RP-2346-01.

Descriptors: *Trout, *Acid rain effects, *Water pollution effects, *Acidic water, *Aluminum, Cations, Hydrogen ion concentration, Biochemistry, Blood, Toxicity, Gases, Tissue analysis, Morbidity, Fish physiology, Physiology, Population exposure,

The relative importance of ionoregulatory and respiratory disturbances in brook trout (Salvelinus fontinalis) under acid/Al stress in soft water is dependent upon water pH and Ca(2+) levels. Trout acclimated to Ca(2+) = 25 or 400 microequiv/L were fitted with arterial catheters and exposed to acid/Al for 10 d under flow-through conditions. Parameters monitored included arterial blood pH (pHa), Pa(O2), Pa(CO2), HCO3(-), delta H(+)m, Na(+), Cl(-), K(+), Ca(2+), protein, lactate, glucose, hemoglobin, and hematocrit. Exposure to pH = 4.8 (no Al) at Ca(2+) = 25 micromols/L caused no mortality and negligible physiological disturbances. Addition of Al (333 micrograms/L or 12.3 micromols/L) results in > 80% mortality (LT50 = 39.0 h) preceded by a marked decrease of plasma Na(+) and Cl(-), a moderate disturbance of blood gases, but no acidosis. At higher Ca(2+) (400 microequiv/L), this same exposure (pH = 4.8, Al = 333 micrograms/L) caused similar mortality (LT50 = 38.5 h) but smaller ionic disturbances, much larger decreases in blood O2, increases in blood CO2, and respiratory acidosis. Exposure to pH = 4.4 (no Al) at Ca(2+) = 25 microequiv/L caused 60% mortality (LT50 = 170.0) preceded by marked ionic disturbances and metabolic acidosis, but little change in blood gases. Addition of Al (333 micrograms/L) increased mortality to > 80% (LT50 = 78.2 h) with smaller ionic but greater respiratory disturbances. (See also W89-03235) (Author's abstract) W89-03236

PHYSIOLOGICAL EVIDENCE OF ACCLIMA-TION TO ACID/ALUMINUM STRESS IN ADULT BROOK TROUT (SALVELINUS FON-TINALIS: I. BLOOD COMPOSITION AND NET SODIUM FLUXES,

McMaster Univ., Hamilton (Ontario). Dept. of Bi-C. M. Wood, D. G. McDonald, C. E. Booth, B. P.

C. M. WOOd, D. O. McDonand, C. E. Booth, B. P. Simons, and C. G. Ingersoll.

Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 9, p 1587-1596, September 1988. 6 fig. 1 tab, 43 ref. Electric Power Research Institute Contract RP-2346-01.

Descriptors: *Acid rain effects, *Water pollution effects, *Trout, *Fish populations, *Acidic water, *Biochemistry, *Aluminum, *Hydrogen ion concentration, Fish physiology, Cations, Morbidity, Physiology, Population exposure, Sodium, Chloride, Blood, Tissue analysis, Adsorption, Stress.

Brook trout (Salvenlinus fontinalis) adapt to chronic sublethal acid/Al stress. The accompanying acclimation confers greater resistance to short-term increases in Al and acidity. Adult trout were exclimation confers greater resistance to short-term increases in Al and acidity. Adult trout were exposed in flowing soft water to eight combinations of pH (6.5, 5.2) times Ca(2+) (25, 400 microequiv/L) times Al (0, 75, 150 micrograms/L = 0, 2.8, 5.6 micromol/L). After 10 wk, blood sampling by caudal puncture revealed no significant variations in osmolality, plasma protein, or hemoglobin and only minor differences (< or = 15%) in plasma Na(+) and Cl(-). Overall, most electrolytes were higher in fish exposed to higher water Al and/or Ca(2+); only plasma Ca(2+) was directly depressed by low pH. Hematocrit was raised by both low pH and elevated Al. When trout naive to both acid and Al were challenged with pH = 4.8, Al = 333 micrograms/L under flow-through conditions, there were large negative whole-body Na(+) and Cl(-), hemoconcentration, an substantial mortality over 48 h. Prior exposure for 10 wk to pH = 5.2 plus either 75 or 150 micrograms Al/L prevented mortality and ameliorated or abolished these effects through a more rapid recovery of net Na(+) balance. Prior exposure to pH = 5.2 alone ameliorated these effects only slightly. (See also W89-03235) (Author's abstract)

PHYSIOLOGICAL EVIDENCE OF ACCLIMA-TION TO ACID/ALUMINUM STRESS IN-ADULT BROOK TROUT (SALVELINUS FON-TINALIS): II. BLOOD PARAMETERS BY CAN-

NULATION, McMaster Univ., Hamilton (Ontario). Dept. of Bi-

Group 5C-Effects Of Pollution

ology.
C. M. Wood, B. P. Simons, D. R. Mount, and H. L. Bergman.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 9, p 1597-1605, September 1988. 4 fig. 3 tab, 45 ref. Electric Power Research Institute Contract RP-2346-01.

Descriptors: *Acclimitization, *Water pollution effects, *Trout, *Acid rain effects, Population exposure, *Fish populations, *Biochemistry, *Acidic water, *Aluminum, *Hydrogen ion concentration, Cations, Morbidity, Physiology, Sodium, Adaptation, Stress, Chloride, Fish physiology, Physiology, Blood.

Brook trout (Salvelinus fontinalis) exposed for 10 wk t sublethal acid (pH = 5.2) plus Al (150 micrograms/L) in flowing soft water (Ca(2+1) = 25 microequiv/L) did not exhibit chronic respiratory disturbance or elevated stress indices, as revealed by sampling of arterial blood gases, acid-base status, glucose, and cortisol via an indwelling catheter. Acclimation occurred, which prevented mortality and greatly attenuated the disturbances of respiratory, acid-base, and stress parameters normally seen upon challenge with more sever acid (pH = 4.8) plus Al conditions (333 micrograms/L) for 3 d. Ionoregulatory, fluid volume, and hematological disturbances were similarly reduced. Higher water Ca(2+) (400 microequiv/L) slightly delayed but did not prevent this suite of toxic responses in naive fish challenged with acid alone (pH Brook trout (Salvelinus fontinalis) exposed for 10 responses in naive fish. These disturbances did not occur in naive fish challenged with acid alone (pH = 4.8). However, long-term adaptation to acid alone (pH = 5.2) resulted in elevated glucose and cortisol levels and offered no protection against the more severe acid plus Al challenge. Thus the acclimation was to Al rather than to acidity itself, and low levels of Al may be beneficial to fish under chronic acid stress. (Author's abstract) W89_03238

SODIUM TRANSPORT IN THE BROOK TROUT, SALVELINUS FONTINALIS: EF-FECTS OF PROLONGED LOW PH EXPOSURE IN THE PRESENCE AND ABSENCE OF ALU-

McMaster Univ., Hamilton (Ontario). Dept. of Bi-

D. G. McDonald, and C. L. Milligan D. U. McDonaid, and C. L. Milligan. Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 9, p 1606-1613, September 1988. 7 fig. 2 tab, 31 ref. Electric Power Research Institute Contract RP-2346-01.

Descriptors: *Acid rain effects, *Trout, *Biochemistry, *Water pollution effects, *Fish populations, *Acidic water, *Aluminum, Mathematical models, Adaptation, Metabolism, Radioactive tracers, Sodium, Fish physiology, Population exposure, Chlorides.

This study examined the effects of prolonged exposure (> or = 10 wk) to low Ca(2+) (25 versus 400 microequiv/L), low pH (pH 5.2 versus 6.3) with and without Al (150 micrograms/L) on Na(+) uptake in adult brook trout (Salvelinus fontinalis). Na(+) uptake (J sub in (Na(+))) was assessed by measuring radiotracer disappearance from the medium at ambient Na(+) (79 microexit/L) explained to the control of the con from the flection at amotient Na(+) (/9 microequiv/L) and in response to acute increases in ambient Na(+). The relationship between J sub in (Na(+)) and concentration of Na(+) was best described by a linear model with the slope of the described by a linear model with the slope of the line a measure of transport activity. Transport activity increased as a result of prolonged low Ca(2+) exposure at pH 6.5, but declined in fish maintained at pH 5.2. These fish showed no compensation in response to low pH; there was no recovery in transport activity when pH was acutely raised to 6.5, and lower pH's further inhibited uptake. In contrast, the Na(+) transport activity of fish maintained at pH 5.2 and 150 micrograms Al/L was significantly greater than that of fish acclimated to pH 5.2 alone and greater than pH 6.5 controls. This indicates that Al exposure induced a compensatory mechanism in the gills that was not seen with low pH exposure alone. (See also W89-03235) (Author's abstract)

EFFECTS OF LOW PH AND ALUMINUM ON VENTILATION IN THE BROOK TROUT (SALVELINUS FONTINALIS),

Calgary Univ. (Alberta). Dept. of Biology. Cargary Oniv. (Anteria). Dept. of Biologya R. L. Walker, C. M. Wood, and H. L. Bergman. Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 9, p 1614-1622, September 1988. 10 fig. 15 ref. Electric Power Research Institute Contract RP-23%6-01.

Descriptors: *Acid rain effects, *Trout, *Water pollution effects, *Fish populations, *Aluminum, *Hydrogen ion concentration, *Respiration, *Acidic water, Population exposure, Fish physiol-

ogy, Blood, Stress.

Brook trout (Salvelinus fontinalis) (acclimated to pH = 6.5, Ca(2+) = 400 microequiv/L), when exposed to acid (pH = 4.8, Ca(2+) = 400 microequiv/L) and Al (333 micrograms/L), responded with a twofold increase in ventilation volume within the first 4 h of the challenge period (100 h). Increased ventilation stroke volume accounted for most of the change in ventilation volume returned to prechallenge values by 6 h, coughing (flow reversal) and increased mucus production at the gills were notable throughout the challenge period. There were no significant changes in oxygen consumption or Pa sub O2, but hemoglobin oxygen content (micromoles per gram of hemoglobin) decreased by 20%. Arterial pH decreased as a result of both respiratory and metabolic disturbances. Exposure to acid (pH = 4.8, Ca(2+) = 400 microequiv/L) in the absence of Al resulted in similar initial changes in ventilation and blood acid-base status; however, ventilation remained similar initial changes in ventilation and blood acid-base status; however, ventilation remained elevated above the prechallenge values throughout the experiment (24 h). The transient increase and subsequent return of ventilation to prechallenge levels in the acid/Al-exposed fish suggests that Al interfered with the mechanism controlling the ventilatory response. (See also W89-03235) (Author's abstract) W89-03240

EFFECT OF LONG-TERM EXPOSURE TO ACID, ALUMINUM, AND LOW CALCIUM ON ADULT BROOK TROUT (SALVELINUS FON-TINALIS; I. SURVIVAL, GROWTH, FECUNDITY, AND PROGENY SURVIVAL,

Wyoming Univ., Laramie. Fish Physiology and Toxicology Lab.

Toxicology Lab.

D. R. Mount, C. G. Ingersoll, D. D. Gulley, J. D. Fernandez, and T. W. LaPoint.

Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 9, p 1623-1632, September 1988. 3 fig. 4 tab, 56 ref. Electric Power Research Institute Contract RP-2346-01.

Descriptors: *Acid rain effects, *Aluminum, *Hydrogen ion concentration, "Water pollution effects, *Trout, *Fish populations, *Acidic water, *Growth, *Fertility, Population exposure, Life cycles, Eggs, Calcium, Mortality, Surface water, Reproduction, Toxicity, Deficient elements.

Adult brook trout (Salvelinus fontinalis) were exposed to concentrations of acid, Al, and Ca representative of acidic and acid-sensitive surface waters. At low pH (4.42-5.03), survival and growth were reduced by elevated Al concentrations (486 micrograms/L) and low Ca concentrations (486 micrograms/L) and low Ca concentrations (mg/L). Fecundity (number of eggs per female) was reduced by exposure to some treatment combinations, but this effect was mediated through reduced growth; number of eggs per unit body weight was not related to treatment. Viability of eggs from all parental exposures was high when Adult brook trout (Salvelinus fontinalis) were exweight was not related to treatment. Another of eggs from all parental exposures was high when incubated in neutral water. In spite of this high viability, eggs from parents exposed to low Ca concentrations showed greater mortality when incubated in the parental exposure conditions than did eggs from unexposed parents. Although the potential for such 'carryover effects' cannot be discounted, it is concluded that impairment of egg production is not a likely mechanism for loss of brook trout populations from acidic surface waters. (See also W89-03235) (Author's abstract) W89-03241

EFFECT OF LONG-TERM EXPOSURE TO ACID, ALUMINUM, AND LOW CALCIUM ON ADULT BROOK TROUT (SALVELINUS FON-TINALIS): II. VITELLOGENESIS AND OSMOREGULATION,

Wyoming Univ., Laramie. Fish Physiology and Toxicology Lab.

Toxicology Lab.

D. R. Mount, J. R. Hockett, and W. A. Gern.

Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 9, p 1633-1642, September 1988, 3 fig, 5 tab, 47 ref. Electric Power Research Institute Contract RP-2346-01.

Descriptors: *Acid rain effects, *Water pollution effects, *Trout, *Population exposure, *Acidic water, *Fish physiology, *Growth, *Reproduction, Osmosis, Fertility, Eggs, Physiology, Calcium, Aluminum, Hydrogen ion concentration, Blood, Stress, Deficient elements, Mortality, Surfect water.

Adult brook trout (Salvelinus fontinalis) were exposed for 193 d (previtellogenesis to spawning) to six combinations of acid, Al, and low Ca. Survival and growth were reduced by low pH combined with low Ca concentrations. After 41 d of exposure, fish in all low PH exposures showed depressed plasma osmolality and Na concentrations, but by day 97 this apparent osmoregulatory stress was compensated for in all but the most severe treatment (pH 4,97, 47 micrograms inorganic Al/L, 0.5 mg Ca/L). At the observed peak of yoking (day 147), fish exposed to this treatment also had mean concentrations of plasma estradiol, vitellogenin, and Ca of only half control values. Fecundity (eggs per female) was significantly reduced as well, but this reduction was due in part to decreased growth. Despite these abnormalities in ionoregulatory and reproductive physiology, fish in all treatment conditions produced mature eggs. Among fish in stressful conditions, individual variation in growth and physiological parameters appeared to be correlated with osmoregulatory status. It is hypothesized that the suite of physiological disturbances observed are linked to osmoregulatory impairment. (See also W89-03235) (Author's abstract)

MORPHOMETRIC CHANGES IN GILL SEC-ONDARY LAMELLAE OF BROOK TROUT (SALVELINUS FONTINALIS) AFTER LONG-TERM EXPOSURE TO ACID AND ALUMI-

Wyoming Univ., Laramie. Fish Physiology and Toxicology Lab.

J. E. Tietge, R. D. Johnson, and H. L. Bergman. Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 45, No. 9, p 1643-1648, September 1988. 4 fig, 3 tab 25 ref. Electric Power Research Institute Contract RP-2346-01.

Descriptors: "Acid rain effects, "Water pollution effects, "Trout, "Fish physiology, "Acidic water, "Aluminum, "Hydrogen ion concentration, Stress, Histology, Physiology, Biochemistry, Respiration, Gills, Population exposure.

Adult brook trout (Salvelinus fontinalis) were exposed for 147 d to three different combinations of acid and Al in soft water (2 mg Ca/L). Samples of gill tissue from each of the three exposure conditions (pH 6.64 + 0 micrograms Al/L, pH 4.91 + 4.3 micrograms Al/L, and pH 4.45 + 393 micrograms Al/L) were examined by light microscopy using high-resolution techniques and morphometric analysis. As compared with fish in control conditions (pH 6.64 + 0 micrograms Al/L), exposure to pH 4.91 without Al significantly increased odume density of lamellar chloride cells. Low pH and elevated Al (pH 4.45 + 393 micrograms Al/L) resulted in increased diffusion distance, white blood cell infiltration of the lymphatic space of the gill tissue (an indicator of tissue damage), and a dramatic increase in lamellar dense cells. These results are consistent with the physiological data trainance increase in nameriar dense cells. These results are consistent with the physiological data that show ionoregulatory stress and decreased respiratory efficiency as typical responses of brook trout exposed to low pH and combinations of low pH and elevated Al. (See also W89-03235) (Au-

Effects Of Pollution—Group 5C

W89-03243

EFFECT OF PH ON IRON AND MANGANESE

UPTAKE BY A GREEN ALGA,
Institut National de la Recherche Scientifique,
Sainte-Foy (Quebec).
R. C. Schenck, A. Tessier, and P. G. C. Campbell.
Limnology and Oceanography LIOCAH, Vol. 33,
No. 4, Part 1, p 538-550, July 1988. 9 fig. 2 tab, 59

Descriptors: *Hydrogen ion concentration, *Algae, *Iron, *Manganese, *Acid rain effects, *Acidity, *Acidity, *Acidic water, *Chlorphyta, *Phytoplankton, Heavy metals, Trace metals, Essential

Experiments were conducted with Mn54 and Fe59 in buffered synthetic solutions to determine the short-term uptake of manganese and iron by the green alga Chlamydomonas variabilis as a function of pH and metal concentration. Over the pH range 7 to 5, the adsorption of Fe(2) and Mn(+2) onto the cell surface was independent of pH, but the fluxes of metals into the cells decreased 2-2-3 times for each unit decrease in pH. Thus increasing acidity decreased metal uptake and, by inference, the effects of the metals on the cell. The uptake of Fe(+2) and Fe(+3) at the same external concentration (0.1 microM) were also compared under conditions where all the metal was dissolved (pH 5). The uptake rates were nearly identical, even though the ratio Fe(+2):Fe(+3) was about 1,000,000. The measured fluxes of Fe(+3) into an algal cell were 10,000 times greater than the calculated diffusive flux of Fe(+3) to the cell surface. The results indicate that the uptake of Fe(+3) involves transport to the cell surface of hydroxy-Fe(+3) species that are in rapid protolytic equilibrium with each other and with the free hydrated ferric iron. (Author's abstract) Experiments were conducted with Mn54 and Fe59

EFFECTS OF CADMIUM EXPOSURE ON FEEDING OF FRESHWATER PLANKTONIC CRUSTACEANS,

CRUSTACEANS, Limnologisch Inst., Nieuwersluis (Netherlands). Vijverhof Lab. R. D. Gulati, C. W. M. Bodar, A. L. G. Schuurmans, J. A. J. Faber, and D. I. Zandee. Comparative Biochemistry and Physiology (C) CBPCEE, Vol. 90, No. 2, p 335-340, 1988. 2 fig, 4 tab. 26 ref.

Descriptors: *Cadmium, *Plankton, *Crustaceans, *Toxicity, *Assimilative capacity, *Water pollution effects, *Water pollution, Lakes, Carbon radioisotopes, *Lakes, The Netherlands, Daphnia, Bosmina, Copepods, Bioassay, Tracers, Sublethal effects, Consumption.

The effects of cadmium in the ambient medium on the assimilation and consumption rates of lake zooplankton were studied in the laboratory employing the C-14 technique. Dominant species of the crustacean zooplankton from Lake Vechten and Oosdrecht Lakes were exposed to cadmium concentrations ranging from 0.010 to 0.100 ppm cadmium for 20 and 48 hours. The inhibitory effects of cadmium on the feeting efficiency were more obvious after 20 and 48 hours. The inhibitory effects of cadmium on the feeding efficiency were more obvious after 48 hours than after 20 hours. In both the lakes, Daphnia sp. seemed to be the most affected cladoceran. This was substantiated by a significant decrease in the assimilation efficiencies for this species in Lake Vechten. This strong decrease appeared to be caused by a greater decline in the assimilation rates than in those of the consumption. This suggests that besides the adverse effect of cadmium exposure on filtering mechanism, activity of the assimilatory enzymes and absorption of food in the gut may be retarded too. Like Daphnia sp., in the gut may be retarded too. Like Daphnia sp., Bosmina sp. was also sensitive to cadmium. The copepods were relatively much less affected. Consumption and assimilation efficiencies appear to be quick and useful measures of studying the toxic effects of cadmium. (See also W89-03289) (Miller-PTT) W89-03288

EFFECTS OF CADMIUM ON CONSUMPTION, ASSIMILATION AND BIOCHEMICAL PA-

RAMETERS OF DAPHNIA MAGNA: POSSI-BLE IMPLICATIONS FOR REPRODUCTION, Utrecht Rijksuniversiteit (Netherlands). C. W. M. Bodar, I. vanderSluis, P. A. Voogt, and D. I. Zandee.

Comparative Biochemistry and Physiology (C) CBPCEE, Vol. 90, No. 2, p 341-346, 1988. 3 tab,

Descriptors: *Cadmium, *Daphnia, *Toxicity, *Water pollution effects, Assimilative capacity, Lipids, Proteins, Crustaceans, Reproduction, Glycogen, Heavy metals, Consumption, Sublethal effects, Assimilation.

Indirect toxic effects of the heavy metal cade Indirect toxic effects of the heavy metal cadmium on the reproduction of D. magna are reported. For this, consumption and assimilation rates were measured at different sublethal concentrations of cadmium. In addition, the effects of cadmium exposure on the levels of glycogen, protein and various lipid-classes were studied. Results were discussed in relation to data of a previous study. The consumption and assimilation experiments indicated a drastic effect of cadmium on the consumption rates of D. magna. At 5.0 ppb cadmium, the content of the consumption of the consumption and assimilation experiments indicated a drastic effect of cadmium on the consumption consumption and assimilation experiments minication and a static effect of cadmium on the consumption rates of D. magna. At 5.0 ppb cadmium, the consumption rates of I-day old daphnids were only 40% of controls. Assimilation rates of cadmium-exposed animals were depressed as well, but this might be due only to the reduced consumption. In this study, glycogen was the only component that decreased constantly with increasing cadmium concentrations at all exposure times. Due to cadmium, the food uptake rate of D. magna was reduced, resulting in lower body weights. The stressed animal starts to deplete glycogen reserves first of all, probably followed by the lipid and finally the protein supplies. In the consumption, assimilation and biochemical experiments of the present study, adult body weights were reduced under cadmium stress. So apparently at the cost of their own health adult body weights were reduced under cadmium stress. So apparently at the cost of their own health and viability, females of D. magna are capable of increasing or at least limiting the loss of the repro-ductive biomass. At concentrations above 5.0 ppb cadmium, daphnids will fail to cope with the lack of nutrients and reproduction will be affected neg-atively as well. (See also W89-03288) (Miller-PTT)

IMPAIRMENT OF MOBILITY AND DEVEL-OPMENT IN FRESHWATER SNAILS (PHYSA FONTINALIS AND LYMNAEA STAGNALIS) CAUSED BY HERBICIDES, Gesamthochschule Kassel (Germany, F.R.). Fach-bereich 19 - Biologie, Chemie. G. J. Kosanke, W. W. Schwipper, and T. W.

Beneke. Comparative Biochemistry and Physiology (C) CBPCEE, Vol. 90, No. 2, p 373-379, 1988. 6 fig, 1

Descriptors: *Snails, *Herbicides, *Toxicity, *Animal behavior, *Water pollution effects, Mobil-ity, Worms, Reproduction, Sublethal effects, Chlorpropham.

Chlorpropham.

The present study attempts to demonstrate that: (1) adult freshwater snails and earthworms are able to take up and concentrate herbicidal compounds, (2) if the force development in their muscle systems is partially inhibited by such substances, the mobility of intact specimen should be reduced, and (3) developing and embryonic stages are involved in the toxic effects involved and where are they affected. The pulmonate freshwater snails Physa and Lymnaea and the earthworms Eisenia and Lymnaea and the earthworms Eisenia and Lumbricus can take up and concentrate a carbamate herbicide (chlorpropham). The mobility of freshwater snails was diminished in the presence of herbicides chlorpropham, cycloate, pentachlor and chloroxurone. The egg-assemblies of Lymnaea stagnalis turned out to be suitable objects for testing the influences of herbicides upon embryonic development. In the presence of chlorpropham, chloroxurone, cycloate, propanil, simazine and terbutryne, all applied in concentrations lower than in practical use, the period of egg-maturing was delayed and the total number of dead embryos increased. Developing snail eggs were very sensitive towards triazine herbicides. Similar herbicidal-induced effects suggested that the developing stages of snail embryos may be suitable for the ecological-

ly more important but experimentally less accessi-ble earthworms. (Miller-PTT) W89-03290

CHRONIC EFFECTS OF CU ON REPRODUCTION OF POLYPEDILUM NUBIFER (CHIRONOMIDAE) THROUGH WATER AND FOOD, National Inst. for Environmental Studies, Tsukuba (Japan). Environmental Biology Div.

S. Hatakeyama. Ecotoxicology and Environmental Safety EESADV, Vol. 16, No. 1, p 1-10, August 1988. 4 fig, 3 tab, 14 ref.

Descriptors: *Water pollution effects, *Reproduction, *Sublethal effects, *Toxicity, *Copper, *Midges, Eggs, Hatching, Food chains, Bioassay, Heavy metals, Mortality.

The effects of copper on the reproduction of Polypedilum nubifer (chironomid) through water and food were examined in a flowthrough aquarium by copper exposure from the egg stage. The emergence success decreased to 74, 38, 16 and 2% of the control at 10, 20, 30 and 40 microgram copper/liter, respectively. However, the oviposition success (number of egg clusters/female) remained at 64% of the control value even at 30 microgram copper/liter. From these results and the acute toxicity tests, it is suggested that a decrease in emergence success was caused mainly by mortality in gence success was caused mainly by mortality in the early instar stage, when copper sensitivity is high. There were no significant effects of copper on the emergence success, oviposition success and on the emergence success, oviposition success and hatchability of the oviposited eggs in the midge which had been given food contaminated with about 330 microg copper/g (dry weight). However, emergence success and hatchability of the oviposted eggs decreased to 30 and 40% of the control in the midge which had been fed food accumulating 1770 microgram copper/g, although the oviposition success was not impaired compared to the control. Emergence did not occur from the aquaria which midges were fed food accumulating 5200. in which midges were fed food accumulating 5200 microgram copper/g. (Author's abstract)

REVIEW OF ENVIRONMENTAL TOXICITY OF QUATERNARY AMMONIUM HALIDES,

International Scholars for Environmental Studies, 107 Canner Street, New Haven, Connecticut

J. C. Cooper. Ecotoxicology and Environmental Safe EESADV, Vol. 16, No. 1, p 65-71, August 1988.

Descriptors: *Toxicity, *Reviews, *Quaternary ammonium compounds, *Water pollution effects, *Industrial wastes, Plant growth, Fish, Inverte-brates, Bacteria, Water pollution, Structure-activi-ty relationships, Chemical structure.

available information on the environmental All available information of the environmensal toxicity of quaternary ammonium compounds is summarized. Ten-minute contact kills of bacteria occur at 50.333 mg/liter. These chemicals are acutely toxic at approximately 1 mg/liter to invertebrates and fish and toxicity is occasionally as low as 0.1 mg/liter; no-effect levels are generally 10 times lower than LC50 values. Toxicity to invertebrate and 65h enabers to be relatively independent times lower than LC50 values. Toxicity to invertee brates and fish appears to be relatively independent structure; the compounds studied, which have a large variety of structures, are all toxic at approxi-mately the same order of magnitude. The quater-nary ammonium compounds tested inhibited plant growth at 3-5 mg/liter. Predictions of toxicity to quaternary are made based on knowledge of struc-ture-activity relationships. (Author's abstract) W89-03298

ASBESTOS-CONTAMINATED DRINKING WATER: ITS IMPACT ON HOUSEHOLD AIR, New York State Dept. of Health, Albany. Wads-worth Center for Labs. and Research. For primary bibliographic entry see Field 5B.

Group 5C-Effects Of Pollution

EFFECTS OF SIMULATED ACID RAIN ON SUGAR MAPLE SEEDLING ROOT GROWTH, State Univ. of New York, Syracuse. Coll. of Environmental Science and Forestry.
C. D. Dustin, and D. J. Raynal.
Environmental and Experimental Botany EEBODM, Vol. 28, No. 3, p 207-213, 1988. 7 tab, 21 ref.

Descriptors: *Acid rain effects, *Water pollution effects, *Maple trees, *Acid rain, Simulated rainfall, Seedlings, Plant growth, Roots, Hydrogen ion

Based on studies of seedling microhabitats in the Based on studies of seedling microhabitats in the field, laboratory experiments were conducted to determine the effects of brief pulses of simulated acid rain on sugar maple seedling root growth. Radicle elongation following seed germination was reduced at pH 3.0 one day after germination, but not after three days or more. After 7 days of growth, seedlings exposed to pH 3.0 showed significant reduction in growth of root hairs compared to those exposed to pH 4.0 rain; however, no significant differences in radicle and root hair growth were found 10 days after seed germination. The growth of the primary and secondary roots was not affected by exposure to simulated acid rain The growth of the primary and secondary roots was not affected by exposure to simulated acid rain of pH 3.0. Evaluation of the findings in relation to natural conditions indicates that generally no direct adverse effects on sugar maple seedling growth are expected. (Author's abstract) W89-03300

RESULTS OF A SHORT-TERM TOXICITY STUDY FOR THREE ORGANIC CHEMICALS FOUND IN NIAGARA RIVER DRINKING

Environmental Health Directorate, Ottawa (Ontar-io). Environmental and Occupational Toxicology

LIV.
E. Komsta, I. Chu, V. E. Secours, V. E. Valli, and D. C. Villeneuve.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 4, p 515-522, October 1988. 3 tab, 10 ref.

Descriptors: *Organic compounds, *Toxicity, *Niagara River, *Drinking water, *Water pollution effects, *Trace levels, Lakes, Rivers, Lake Ontario, Sublethal effects, Rats, Enzymes.

To assess the potential adverse effects in humans associated with the ingestion of trace chemicals found in the Niagara River and Lake Ontario, short-term toxicity studies (4 weeks) on dibromomethane, hexanal, and tetrahydrofuran in the rat were carried out. Data indicated that administrawere carried out. Data indicated that administra-tion of the three chemicals via drinking water up to 1000 mg/L produced no overt toxic effects. Although treatment-related morphological changes were observed in the highest dose groups; these were considered to be mild and adaptive in these were considered to be mild and adaptive in nature, and could not be related to any functional changes. The only biochemical parameter affected by treatment was the reduced lactic dehydrogenase activity in hexanal and dibromomethane treated female rats. However, the biological significance of this change is uncertain. The growth rate and hematological parameter were not affected. Since the levels of the three chemicals in Niagra drinking water are reported to be 0.2 to 0.8 microg/L which is 1/1000 of the concentration of the lowest dosing solution (1 mg/L) given to the test animals, the data indicate that there exists at least a 1000 fold concentration factor between the levels of chemicals found in the Niagra drinking water and the levels that thid not produce signifiwater and the levels that did not produce signifi-cant biological effects in the rats. (Miller-PTT) W89-03310

CHRONIC EFFECTS OF CONTAMINATED SEDIMENT ON DAPHNIA MAGNA AND CHIRONOMUS TENTANS, Corvallis Environmental Research Lab., OR. A. V. Nebeker, S. T. Onjukka, and M. A. Cairns. Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 4, p 574-581, October 1988. 5 tab, 10 ref.

Descriptors: *Daphnia, *Midges, *Water pollution, *Water pollution effects, *Sediments, *Toxicity,

Superfund sites, Soil contamination, Bioassay, Copper, Mine was

Chronic tests were conducted with Daphnia magna and Chironomus tentans to determine their usefulness as test organisms for chronic sediment assays, and to estimate the potential long-term impact of contaminated freshwater sediments and assays, and to estimate the potential long-term impact of contaminated freshwater sediments and contaminated Superfund site soils on freshwater invertebrates. Three types of Daphnia chronic tests were conducted. Daphnia 10-day chronic tests at 20 C, starting with 5-day old animals, were successfully completed with nine sediment samples. The tests were easy to set up and recovery of the large 15-day old Daphnia and the older (> 2 day) young with 0.5 mm screen was satisfactory. Daphnia 7-day chronic tests at 22 C, starting with 6-day old animals, were successfully completed with samples from Soap Creek Pond, two Superfund sites, and water-only controls. Two broods normally hatch during the 7-day period, and are easily separated by size when counted. In the toxic sample from the Douglasville site, no adult mortality occurred during the 7-day test period. Production of first brood was limited, and no second brood eggs developed in those animals that successfully released the first brood. Six chironomus larval survival tests were conducted with larval survival tests were conducted with larval recoveries ranging from 68-92%. Sediment from Little Grizzly Creek, containing high concentrations of copper from mine tailings, killed all larvae; no other sediment was so obviously toxic to chironomus. (Miller-PTT)

ACUTE TOXICITY AND BEHAVIORAL EFFECTS OF ACRYLATES AND METHACRY-LATES TO JUVENILE FATHEAD MINNOWS, Environmental Research Lab-Duluth, MN. C. L. Russom, R. A. Drummond, and A. D.

Hoffman.

Forman. Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 4, p 589-596, October 1988. 2 fig, 1 tab, 15 ref.

Descriptors: *Water pollution effects, *Toxicity, *Fish behavior, *Fathead minnows, *Pollutant identification, Acrylates, Methacrylates, Quantitative structure-activity relationship, Bioassay, Pre-

To better define quantitative structure-activity re-lationships for acrylates and methacrylates, flow-through 96-h acute toxicity tests were conducted using juvenile fathead minnows. The 96-h LC30 through 96-h acute toxicity tests were conducted using juvenile fathead minnows. The 96-h LC50 was then correlated against log P. Log P was used as an independent variable to compare this study's findings with the quantitative structure-activity relationship reported by Veith and others in 1985. In coordination with the toxicity test, a behavioral screen was conducted. Previous work on classification of chemicals based on behavioral and morphological signs as stress using the inventile fathead logical signs as stress, using the juvenile fathead minnow, proved to be helpful in predicting mode of action. The results demonstrate that acrylates and methacrylates, in general, exhibit separate modes of action, with acrylates being more toxic. (Miller-PTT) W89-03313

IN VIVO AND IN VITRO EFFECT OF TRI-CLORFON ON ESTERASES OF THE RED CRAYFISH PROCAMBARUS CLARKII,

CRAYFISH PROCAMBARUS CLARKII, Instituto Nacional de Toxicologia, Seville (Spain). G. Repetto, P. Sanz, and M. Repetto. Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 4, p 597-603, October 1988. 7 fig, 8 ref.

Descriptors: *Pesticides, *Piscicides, *Nervous system, *Water pollution effects, *Crayfish, *Triclorfon, Bioassay, Enzymes, Insecticides, Organophosphorus pesticides.

The lethal concentration of 0.0-dimethyl (1-hy-The lethal concentration of 0,0-dimethyl (1-hydroxy 2,2,2-trichloroethyl) phosphonate was investigated and a biochemical study of the extent of its effect on muscle and hepatopancreas was initiated. This required setting up the method of detection of neuro target esterase in muscular tissue of crayfish. The approximate LC50 concentration of 0,0-di-

methyl (1-hydroxy 2,2,2-trichloroethyl) phosphonate on Procambarus clarkii at 96 hours of exposure was 5 mg/l at 20 C. Once the LC 50 was established, the effect on muscular cholinesterase, muscular glycogen, and hepatic glycogen of different concentrations of 0,0-dimethyl (1-hydroxy 2,2,2-trichloroethyl) phosphonate at 24 hours exposure was studied. The results of these experiments indicate that, in this acute phase, an increase in acetylcholine esterase (AChE) was observed, followed by progressive reduction as the concentration of 0,0-dimethyl (1-hydroxy 2,2,2-trichloroethyl) phosphonate in the environment increased. The effects observed with low concentrations of 0,0-dimethyl (1-hydroxy 2,2,2-trichloroethyl) phosphonate were also studied. The results indicate that the activity of AChE increased slowly with an abrupt decrease at 4 days and recuperation later. (Miller-PTT) W89-03314

TOXICITY OF SIX HETEROCYCLIC NITRO-GEN COMPOUNDS TO DAPHNIA PULEX, National Fisheries Research Center-Great Lakes.

Ann Arbor, MI.

Ann Artoor, MI. C. M. Perry, and S. B. Smith. Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 4, p 604-608, October 1988. 1 tab, 12 ref.

Descriptors: *Daphnia, *Nitrogen compounds, *Toxicity, *Water pollution effects, Bioassay.

The relative toxicities to the aquatic crustacean Daphnia pulex were determined for six heterocyclic nitrogen compounds, including nicotine and isoxanthopterin. These compounds were selected because they were detected in lake trout or wall-leves and were compensation and administration of the compound isoxanthopterin. These compounds were selected because they were detected in lake trout or walleyes and were commercially available. Daphnia pulex was used as the test organism because it is endemic to the Great Lakes, is easy to culture, has parthogenic reproduction, constant genetic makeup over generations, and is sensitive to ecological stress. The data demonstrated that nicotine,—methyl-pyrrolidine,—2-amino-4,6-dimethylpyridine,—2-pyrrolidinone,—and—2-(2-hyroxyethyl)pyridine ranged from highly to moderately toxic. These compounds may alter the distribution, density, and behavior of aquatic organisms by lethal or sublethal action, and indirectly affect a species' food or response to competition and predation. Stress to the daphnid populations may affect forage fish populations that depend either directly or indirectly on zooplankton as a food source in the Great Lakes. (Miller-PTT) W89-03315

EVALUATION OF THE ACUTE TOXICITY TO JUVENILE PACIFIC SALMONIDS OF HEXAZINONE AND ITS FORMULATED PRODUCTS: PRONONE 10G, VELPAR L, AND THEIR CARRIERS,

IHEIR CARRIERS, Inland Waters Directorate, Vancouver (British Co-lumbia). Pacific and Yukon Region. M. T. Wan, R. G. Watts, and D. J. Moul. Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 4, p 609-616, October 1988. 6 tab, 15 ref.

Descriptors: *Toxicity, *Water pollution effects, *Salmon, *Herbicides, Bioassay, Vegetation ef-

The acute toxicity of hexazinone and its formulated products and their carriers to juvenile salmonids was assessed. A series of 96 hour static acute toxicity tests were conducted from February to May 1987 in accordance with the protocols of Environment Canada. Hexazinone was toxic to juvenile Pacific salmonids. This herbicide is more toxic to the same fish species than its formulated products, Pronone 10G and Velpar L. The carriers of both products are of low toxicity to the salmonids, and they appear to reduce the toxicity of hexazinone in the formulated materials. The toxic effect to young salmon of hexazinone transformation products is presently not known. However, due to its mobility and persistance, hexazinone has the potential to destroy riparian vegetation of salmon habitat. (Miller-PTT)

Waste Treatment Processes—Group 5D

W89-03316

PORTABLE ENVIRONMENT TEST SYSTEM: A FIELD ASSESSMENT OF ORGANOTIN LEA-CHATES. TEST AND EVALUATION, Naval Ocean Systems Center, San Diego, CA. S. M. Salazar, M. H. Salazar, B. M. Davison, P. M. Stang, and K. Meyers-Schulte. Available from the National Technical Information Service, Springfield, VA 22161, as AD-A192 119. Price codes: A03 in paper copy, A01 in microfiche. Technical Report 1202, November 1987. 29p, 9 fig, 5 tab, 38 ref.

Descriptors: *Water pollution effects, *Pesticides, *Tin, *Organotin, *Field tests, On-site tests, Leachates, Tributyltin, Biological studies, Bioassay, Mussels, Oysters, Clams, Path of pollutants.

Mussels, Oysters, Clams, Path of pollutants.

A Portable Environmental Test System (PETS) was evaluated with tributyltin (TBT) antifouling leachates in San Diego Bay over a 7-month period. Overall mean test concentrations were 0.065, 0.077 and 0.193 micrograms/L TBT. Treatments were tested against ambient seawater controls with three replicates of each using 340-L tanks. Unfiltered seawater was pumped over a TBT-coated panel, creating a TBT-leachate diluted with ambient seawater contions and indicated to test tanks. The following parameters were measured: abundance and species diversity on fouling panels; condition and gonad indices, and bioaccumulation in adult mussels; condition indices and bioaccumulation in clams; and growth rates in juvenile mussels and juvenile oysters. There appeared to be several indications of effects at the highest concentration tested, although statistically significant differences were not consistently measured. At all TBT concentrations, adult mussels and clams accumulated TBT and juvenile mussels and clams accumulated TBT and juvenile mussels growth was reduced. However, growth of juvenile mussels and vasters in PETS tanks was significantly slower than growth of control animals held in the bay near the system seawater intake. These results suggest test animals in PETS tanks may have been under stress from the test system. It is not clear whether results represent affects to be expected in nature; the particular bioindicators selected may have been resistent to TBT and insensitive to measuring significant effects, or variability and system inadequacies reduced the ability to measure significant effects. (Author's abstract)

CHLORINE SENSITIVITY OF EARLY LIFE STAGES OF FRESHWATER FISH, Science Applications, Inc., Oak Ridge, TN. S.-C. Tsai, J. S. Mattice, J. R. Trabalka, M. B. Burch, and K. B. Packard.
Available from the National Technical Information Service, Springfield, VA 22161, as DE88-003776.
Price codes: A03 in paper copy, A01 in microfiche. Report No. CONF-870524-2, (1987). 17p, 5 fig. 2 tab, 15 ref. EPA Contract 40-740-78 and DOE Contract DE-AC05-840R21400.

Descriptors: *Chlorine, *Fish, *Life history studies, *Water pollution effects, Biological studies, Bioassay, Hydrogen ion concentration, Carp, Mosquitofish, Larvae, Lethal limits, Toxicity, Em-

Elemental chlorine is widely used in electric power plants to control aquatic organisms that attach to the condenser cooling system, and the microfouling organisms which affect the efficiency of heat transfer from hot steam in the generator to the condensers. In of heat transfer from hot steam in the generator to cooling water flowing through the condensers. In a typical power plant, about 2200 kg of chlorine is flushed through the condenser cooling system daily and discharged into receiving waters. To determine the toxicity of chlorine to the most sensitive life stages of fish, a flow-through system suitable for measuring the acute toxicity to all life stages of fish, from 1-h old embryos to 256-d old fingerlings, was developed. LC50 values were then measured for free residual chlorine to three species of fish at various life stages. The major variable affecting the chlorine sensitivity of fish was the life stage of the test fish. The embryonic stages are far less sensitive to chlorine than other life stages. The

10-h hardened egg of common carp, with a 1-h LC50 of 158 (128 - 213) mg/L in the original test medium, was the least sensitive life stage. The most sensitive life stage is the prolarvae. THE LC50 sensitive life stage is the prolarvae THe LC30 values for prolarvae of common carp and threadfin shad were 330 and 260 micrograms/L, respectively. The effect of water pH and water hardness on the chlorine sensitivity were limited. The variation of LC50s caused by the changes in pH or hardness is less than a factor of 3 in common carp and mosquitofish. Data suggested that sensitivity of fish to chlorinated discharges may depend on the life stage that is exposed; it appears that fish larvae, especially those just hatched, may provide the most appropriate stage for testing. (Lantz-PTT) W89-03333

5D. Waste Treatment Processes

PROCESS DEVELOPMENT AND TREAT-MENT PLANT STARTUP FOR AN EXPLO-SIVES INDUSTRY WASTEWATER,

es, Inc., Wilmington, DE Hercules, Inc. D. M. Potter.

DN. International Conference on Innovative Biological Treatment of Toxic Wastewaters. June 24-26, 1986, Arlington, Virginia. April 1987. p 390-422, 12 fig. 7 tab, 2 ref.

Descriptors: *Wastewater treatment, *Industrial wastewater, *Explosives, *Toxic wastes, *Biological treatment, Activated sludge processes, Aerobic treatment, Anaerobic digestion, Toxicity, Fathead minnows, Bacteria, Lethal limits, Water pollution

This case study covers the process development and treatment plant startup for the Hercules plant in Kenvil, New Jersey. Two treatment processes were modeled on bench-scale, the first being a conventional aerobic activated sludge process. The conventional aerooic activated studge process. The second study was of a two-stage anaerobic/aerobic activated sludge process. There were some very similar aspects to both treatment processes which were investigated and the one which was eventual-ly built on full scale. No matter which process was y built on full scale. No matter which process was used, there was a prolonged acclimation period associated with this wastewater. The raw wastewater was acutely toxic to fathead minnows at very low concentrations. Apparently, it takes a substantial period of time to develop bacteria which are able to degrade this wastewater. Also potable with both processes was the high state. Also which are able to degrade this wastewater. Also notable with both processes was the high sludge retention time that developed from successful bench-scale conditions. In the case of the strictly aerobic process, the SRT was 21 days. In the case of the combined two-stage anaerobic aerobic process, the SRT was 160 days. The long SRT is indicative of the recalcitrant nature of the organics in this wastewater. Once one has developed bacteria which are capable of degrading these organics, the bacteria must be maintained in the system for a long period of time in order to successfully treat the wastewater. Also characteristic of both systems investigated was complete toxicity removal. After the wastewater. Also characteristic of both systems investigated was complete toxicity removal. After treatment, a raw wastewater with an LC sub 50 of 2% volume is completely non-toxic. Perhaps most important, all of the results demonstrate that with important, ail of the results demonstrate that with patience and proper process control and acclima-tion, conventional biological treatment processes are capable of successfully treating acutely toxic wastewaters. (See also W89-02267) (Lantz-PTT) W89-02287

UTILIZATION OF NITRITE OXIDATION IN-HIBITION TO IMPROVE THE NITROGEN ELIMINATION PROCESS, Toronto Univ. (Ontario). Dept. of Civil Engineer-

Suthersan, and J. J. Ganczarczyk S. Suthersan, and J. J. Ganczarczyk.

IN: International Conference on Innovative Biological Treatment of Toxic Wastewaters. June 24-26, 1986, Arlington, Virginia. April 1987. p 423-445, 6 fig, 1 tab, 22 ref.

Descriptors: *Nitrogen removal, *Nitrites, *Oxida-tion, *Denitrification, *Wastewater treatment, Bio-logical treatment, Nitrification, Ammonia, Hydro-gen ion concentration, Nitrogen fixing bacteria, Biomass.

Under the usual circumstances in biological waste treatment systems, the phenomenon of inhibition is considered as an event deteriorating the performance of the system. But, for the purpose of modifying the nitrification - denitrification process, inhibition could be advantageous. The concept of 'Recovery Time' was introduced to study the inhibition of the second stage of nitrification. It was found that, in addition to the inhibitiory effects caused by free ammonia (FA), the pH itself played an additive role in the inhibition of Nitrobacter. By continuously and gradually acclimatizing. Nitro-continuously and gradually acclimatizing. Nitrocaused by free ammonia (FA), the pH itself played an additive role in the inhibition of Nitrobacter. By continuously and gradually acclimatizing Nitrobacter to increasing FA concentrations, it was found that adaptation to higher concentrations too place. But this adaptation was found to be only temporary and, by de-adapting, the Nitrobacter regained its original characteristics. Thus, by intermittently providing inhibitory and recovery environments in the inhibition chamber and aeration tank, respectively, the adaptation of Nitrobacter, to higher FA concentrations could be prevented. The more adverse the inhibitory environment was, the time taken by Nitrobacter for complete recovery was significantly longer. The initial recovery of Nitrobacter was found to be much slower than the later stage of this phenomenon. Higher exposure times increased the recovery time obtained under the same conditions, particularly at lower FA concentrations. Higher biomass concentrations were found to be less sensitive to the same inhibitory conditions than were the more diluted mixed liquors. During the initial period when brought back to favorable conditions, the activity of Nitrosomonas was reduced due to the inhibitory environment provided earlier to suppress Nitrobacter activity. A continuous flow modification of the activity of continuors flow modification of the activity. A continuous flow modification of the activity of Nitrosomonas was reduced due to be possible. (See also W89-02288) W89-02288

ANAEROBIC TREATMENT OF MOLASSE/ SUGAR CANE STILLAGE WITH HIGH MIN-ERALS

Societe Generale pour les Techniques Nouvelles, Saint-Quentin-en-Yvelines (France). M. Henry, E. Michelot, and J. P. Jover.

IN: International Conference on Innovative Biological Treatment of Toxic Wastewaters. June 24-26, 1986, Arlington, Virginia. April 1987. p 446-451, 2 tab.

Descriptors: *Anaerobic digestion, *Sugarcane, *Wastewater treatment, Food processing wastes, Molasses, Minerals, Chemical oxygen demand,

Mesophilic anaerobic digestion of molasse cane stillage containing high level of minerals has been studied with a 25 L fixed film reactor. At a constant loading rate of 16 kg COD/cu m/d, the reactor is fed with diluted molasse cane stillage, this dilution is then progressively reduced, leading to an increase of soluble minerals in reactor form 2 up to 26.5 g/L without decreasing of the system performances, in terms of gas productivity and pollution abatement. Hydraulic detention time: 3.8 days; loading rate: 16 kg COD/cu m/d; biogas productivity: 5.3 cu m/cu m/d; and COD removal: 71%. (See also W89-02267) (Lantz-PTT) W89.02789

POTENTIAL FOR ANAEROBIC TREATMENT OF HIGH SULFUR WASTEWATER IN A UNIQUE UPFLOW - FIXED FILM - SUSPEND-ED GROWTH REACTOR,

Sydlo, Inc., Mississauga (Ontario).

S. Love. L. S. Love. IN: International Conference on Innovative Biological Treatment of Toxic Wastewaters. June 24-26, 1986, Arlington, Virginia. April 1987. p 452-463, 6 ref, append.

Descriptors: *Anaerobic digestion, *Wastewater treatment, *Sulfur, Sulfides, Biological treatment, Biogas, Odor control.

Three basic groups of bacteria are responsible for the anaerobic degradation of the organic compo-nent of wastewater: (1) acid forming bacteria, (acid

Group 5D—Waste Treatment Processes

formers) breakdown the complex organic compounds into simple organic acids, aldehydes, ketones and alcohols; (2) methane formers which utilize the volatile fatty acids to produce a biogas containing about 70% methane (CH4) and 30% carbon dioxide (CO2); and (3) desulfovibrio, bacterior, dioxide (CO2); and (4) desulfovibrio, dioxide (CO2); and (4) desulfovibrio (CO2); and (4) desulfovibrio (CO2); and (4) desulfovibrio caroon dioxide (CO2); and (3) desultovibrio, bacteria which reduce sulfate compounds to produce hydrogen sulfide (H2S) and therefore are the source of rather serious odor, corrosion and toxicity problems. The Sydlo anaerobic reactor has been ty problems. The Sydlo anaerobic reactor has been designed specifically to remove large quantities of biogas as it is generated within the reactor. Because of this feature it is ideally suited for the treatment of high sulfur wastewater. The degree of soluble sulfide removal can be controlled by selecting the appropriate supernatant recycle rate. Simple, adjustable weirs are provided, on the gas separators, for this purpose. The advantage of this technology is that it will substantially reduce daily operating costs. Although this reactor is particularly well suited for the treatment of high sulfur wastewaters, it may also be used, with considerable advantage, when treating other wastewaters where advantage, when treating other wastewaters where sulfide toxicity is not a problem. (See also W89-02267) (Lantz-PTT)

ANAEROBIC DIGESTION OF CHEMICAL IN-DUSTRY WASTEWATERS CONTAINING TOXIC COMPOUNDS BY DOWNFLOW FIXED

TOXIC COMPOUNDS BY DOWNFLOW FIXED FILM TECHNOLOGY.
Societe Generale pour les Techniques Nouvelles, Saint-Quentin-en-Yvelines (France).
M. Henry, Y. Thelier, and J. P. Jover.
IN: International Conference on Innovative Biological Treatment of Toxic Wastewaters. June 24-26, 1986, Arlington, Virginia. April 1987. p 464-472, 2 fig. 4 tab, 3 ref.

Descriptors: *Toxic wastes, *Anaerobic digestion, *Chemical industry, *Industrial wastewater, *Wastewater treatment, Fixed films, Biological treatment, Methane bacteria, Biomass, Toxicity.

Treatment of high-strength acidic wastewater con Treatment of high-strength acidic wastewater containing cyclic acetals in a 20 cu m industrial-scale downflow mesophilic, SGN anaerobic fixed film process occurred without any problems after reaching a loading rate of 11 kg COD/cu m/d within 7 months. These compounds showed reversible inhibitory effects against methanogenesis microbial biomass during start-up phase. Specific probes for anaerobic digestion process control in industrial full-scale plant should allow a very quick reaction in case of abnormal concentrations of some toxic compounds in disester influent to present a compound of the compou some toxic compounds in digester influent to prevent biological treatment capacity upsets. (See also W89-02267) (Lantz-PTT) W89-02291

TREATMENT OF PROCESS WASTEWATER FROM PETROCHEMICAL PLANT USING A ROTATING BIOLOGICAL CONTACTOR - A

CASE STUDY,
Royce Process Equipment Co., Inc., Pearland, TX.
W. C. Davis, and T. M. Pankratz.

W. C. Davis, and I. M. Pankratz.

IN: International Conference on Innovative Biological Treatment of Toxic Wastewaters. June 24-26, 1986, Arlington, Virginia. April 1987. p 473-483, 7 fig. 2 tab, 3 ref.

Descriptors: *Wastewater treatment, *Chemical industry, *Oil industry, *Hazardous wastes, *Biological treatment, Case studies, Field tests, Chemical oxygen demand, Organic carbon, Activated carbon, Aerobic treatment

A six month field pilot study, using a rotating biological contactor (RBC), was conducted at a southern petrochemical plant. The purpose of this study was to determine the feasibility of the RBC process as a means of treating a unique industrial wastewater for direct discharge. The field pilot study using this wastewater demonstrated the feasibility of the RBC process in applications with diverse/unique wastes with varying strengths and flows. Effluent from the pilot plant complied with all requirements of the permit restrictions for COD and TOC at a loading rate of 3.38 lbs COD/1000 and TOC at a loading rate of 3.38 lbs COD/1000 sq ft/d. Powdered activated carbon did not show any apparent COD reduction for this particular

wastewater. Discs rotation may not supply suffi-cient oxygen for aerobic respiration in all operat-ing conditions. Supplemental air may be required. (See also W89-02267) (Lantz-PTT) W80.02202

LAND TREATMENT OF NITROGUANIDINE

WASTEWATER, Weston (Roy F.), Inc., West Chester, PA. R. T. Williams, A. R. MacGillivray, and D. E.

nenaro.

IN: International Conference on Innovative Biological Treatment of Toxic Wastewaters. June 24-26, 1986, Arlington, Virginia. April 1987. p 484-489, 9 ref.

Descriptors: *Hazardous wastes, *Land disposal, *Wastewater treatment, *Nitroguanidine, Guani-dine nitrate, Ammonia, Nitrates, Sulfates, Organic compounds, Microbiological studies.

Nitroguanidine (NQ) wastewaters contain nitroguanidine, guanidine nitrate (GN), ammonia, nitrate, and sulfate. Simulated NQ wastewater is being applied to continuous and perfusion soil columns, with continuous flow column influent and effluent samples being analyzed for wastewater components and transformation products (nitroso-councidine, quantifice covannidae, palentine and components and transformation products (nitroso-guanidine, guanidine, cyanamide, melamine, and cyanoguanidine). Whey, molasses, and glucose are being tested as carbon supplements. Mineralization rate experiments are being conducted using 14-C-NQ and 14-C-GN as test substrates. The number of microbes capable of degrading NQ and GN is being determined, as is microflora acclimation. Preliminary data indicate that carbon supplements Preliminary data indicate that carbon supplements facilitate NG degradation after 70 days of application in continuous flow soil columns. Batch minertion in continuous now soil columns. Back miner-alization experiments generally support these find-ings. To date, cyanamide is the only transformation product detected in significant quantities. (See also W89-02267) (Author's abstract) W89-02293

COMBINED FIXED BIOLOGICAL FILM MEDIA AND EVAPORATIVE COOLING MEDIA TO SOLIDIFY HAZARDOUS WASTES FOR ENCAPSULATION AND EFFICIENT DIS-

S. F. Roe.

S. F. Roe. IN: International Conference on Innovative Biological Treatment of Toxic Wastewaters. June 24-26, 1986, Arlington, Virginia. April 1987. p 490-504, 4 fig. 10 ref.

Descriptors: *Wastewater treatment, *Hazardous wastes, *Encapsulation, *Waste disposal, *Evaporation, Costs, Economic aspects, Waste manage-

Hazardous wastes are a problem; not only because they are toxic, but also because they often occur in dilute solution. Although the waste may have been dilute solution. Although the waste may have been concentrated when it was dumped or used; rain water, surface water, groundwater, or wastewater frequently dilutes the waste. The premise of this paper is that the process problem is not only to detoxify the waste, but to concentrate it. Outlined is a particular kind of evaporation process common in evaporative cooling for agricultural and industrial uses. The emphasis however, is not cooling but evaporation of water in combination with biotechnology, volatile stripping, and other convenional unit operations. Further, the evaporative process described here emphasizes purposely scaling or fouling the evaporative cooling media, encapsulating it, and disposing of it as a solid waste. ing or fouling the evaporative cooling media, en-capsulating it, and disposing of it as a solid waste. A second possibility is to incinerate the evapora-tive cooling media containing the hazardous waste. Existing technologies are discussed in terms of conventional evaporation, utility cooling tower evaporation, evaporative cooling, VOC stripping, and fixed film biotechnology. Additional discus-sion include a process description and a process example as well as the various combinations of aerobic-anaerobic disestion and exaporation. The example as well as the various combinations on aerobic-anaerobic digestion and evaporation. The evaporative cooling process is perhaps intermedi-ate between evaporative ponds and multistage evaporators. The process shares the low energy and capital costs of evaporative ponds without the disadvantage of rain water dilution suffered by

evaporative ponds. (See also W89-02267) (Lantz-PTT) W89-02294

FATE OF COD IN AN ANAEROBIC SYSTEM TREATING HIGH SULPHATE BEARING WASTEWATER,

Newcastle upon Tyne Univ. (England). Dept. of

G. K. Anderson, T. Donnelly, J. A. Sanderson, and C. B. Saw.

IN: International Conference on Innovative Biological Treatment of Toxic Wastewaters. June 24-26, 1986, Arlington, Virginia. April 1987. p 505-532, 6 fig. 6 tab, 26 ref.

Descriptors: *Chemical oxygen demand, *Anaerobic digestion, *Sulfates, *Wastewater treatment, Acidic waters, Fats, Oil refineries, Biological treatment, Sulfur bacteria, Comparison studies, Performance evaluation.

Two pilot plants, anaerobic contact process and an anaerobic packed bed reactor were operated on site, treating a high sulfate bearing wastewater from an edible oil refinery. The objectives of the research project were: to test the amenability of wastewater from the acid water fat trap to treatwastewater from the acid water fat trap to treatment in continuously operated anaerobic process; and to compare the relative performances of two anaerobic process configuration. Anaerobic processes operating on sulfate-bearing acid water from edible oil refining result in the development of a microbial system with sulfate reducing bacteria, rather than methanogenic bacteria as the main terminal group responsible for the majority of the COD removal capacity. This paper presents the data obtained from the pilot plant study to date and discusses the ability of the anaerobic systems to degrade fate and dissolved organics in the presence of sulfate. (See also W89-02267) (Lantz-PTT) W89-02295) W89-02295

FATE OF 4,6-DINITRO-O-CRESOL IN MUNICIPAL ACTIVATED SLUDGE SYSTEMS,

Environmental Protection Service, Burlington (Ontario). Waste Water Technology Centre.
H. Melcer, and W. K. Bedford.

In: International Conference on Innovative Biological Treatment of Toxic Wastewaters. June 24-26, 1986, Arlington, Virginia. April 1987. p 533-542, 1 fig. 4 tab, 8 ref.

Descriptors: *Toxic wastes, *Pesticides, *Wastewater treatment, *Activated sludge processes, *Municipal wastewater, *Dinitrocresol, Biological treatment, Sludge digestion, Hydraulic retention time, Biodegradation, Fate of pollutants.

Municipal activated sludge systems operated at a 6-hr hydraulic retention time (HRT) and sludge retention time (SRT) of 5 to 15 days can degrade 4,6-dinitro-o-cresol (DNOC) from levels in the range 0.3 to 1.2 mg/L to detection limits. At SRTs of < 5 days, DNOC removal is incomplete. Insignificant losses of DNOC by volatilization were observed. The major mechanism of DNOC removal appeared to be by biodegradation accounting for 93 to 98% removal of the DNOC fed to the systems. (See also W89-02267) (Lantz-PTT) W89-02296

PILOT-SCALE ANAEROBIC BIOMASS ACCLI-MATION STUDIES WITH A COAL LIQUE-FACTION WASTEWATER,

Dearborn Chemical Co. Ltd., Mississauga (Ontar-

D. N. Young, E. R. Hall, and E. B. Vale. IN: International Conference on Innovative Biological Treatment of Toxic Wastewaters. June 24-26, 1986, Arlington, Virginia. April 1987. p 543-573, 9 fig. 9 tab, 20 ref.

Descriptors: *Wastewater treatment, *Anaerobic digestion, *Coal liquefaction, *Pilot plants, Industrial wastewater, Biomass, Biodegradation, Organic compounds, Phenols, Methane, Activated

Waste Treatment Processes—Group 5D

Neither readily-biodegradable organic co-substrate addition nor low severity solvent extraction pretreatment improved the acclimation of anaerobic biomass in anhybrid reactors to H-Coal process wastewater. Acclimation to increasing organic loading rates by hydraulic retention time (HRT) reduction at sub-inhibitory feed strengths of the H-Coal wastewater resulted in higher loading rates attained in both the anhybrid and granular activated carbon (GAC) fluidized bed reactors than the alternate strategy of increasing feed strength at long HRTs. The study results show the beneficial effect of GAC media on anaerobic treatment of a toxic wastewater. Maximum organic loading rates of 2.6 kg COD/cu m/d at 0.78 days HRT and 13% v/v feed strength and 21 kg COD/cu m/d at 0.39 days and 25% feed strength were attained in the anhybrid and GAC fluidized bed reactor respectively over an acclimation period of approximately one year. A maximum feed strength of 40% v/v was treated in the GAC fluidized bed reactor during non-steady-state conditions at an organic was treated in the GAC fluidized bed reactor during non-steady-state conditions at an organic loading rate of 8.7 kg COD/cu m/d and influent total phenolics concentration of 2000 mg/L. Gas was produced at similar rates in both reactor types with a consistent methane content of 70%. Careful acclimation of the biomass by monitoring phenolics-degrading activity coupled with pre-saturation of the activated carbon media by phenolic compounds prior to start-up should allow a significant reduction in the acclimation periods of GAC fluidized bed reactors treating high strength phenolic wastewaters. The overall results indicate that anaerobic treatment of a toxic high-strength phenolic wastewater can be carried out at organic loading aeronic treatment of a toxic ingn-strength pnenolic wastewater can be carried out at organic loading rates similar to those used with a readily biodegradable wastewater following a carefully executed acclimation phase. (See also W89-02267) (Lantz-PTT)

ANOXIC/OXIC ACTIVATED SLUDGE TREAT-MENT OF CYANOGENS AND AMMONIA IN THE PRESENCE OF PHENOLS, Pennsylvania Univ., Philadelphia. Dept. of Civil

Engineering.

D. J. Richards, and W. K. Shieh.

IN: International Conference on Innovative Biological Treatment of Toxic Wastewaters. June 24-26, 1986, Arlington, Virginia. April 1987. p 574-584, 2 fig. 3 tab, 17 ref.

Descriptors: *Toxic wastes, *Wastewater treatment, *Activated sludge processes, *Cyanogenic, *Ammonia, *Phenols, Cyanide, Thiocyanates, Organic carbon, Industrial wastewater, Biological

Petrochemical, steel manufacturing, mining and synthetic fuel processing are among several industries that generate wastewaters containing relatively high concentrations of phenols, cyanide, thio-cyanate and ammonia. Individually these compounds have severe environmental consequences. Also well documented is the toxicity of cyanide and the adverse effects on health of both phenolic compounds and nitrates. This paper primarily describes and discusses an on-going laboratory investigation which evaluates the efficacy of an anoxic oxic activated sludge system for treating this type oxic activated sludge system for treating this type. tigation which evaluates the efficacy of an anoxic/ oxic activated sludge system for treating this type of wastewater, with the following objectives: to compare the effect of cyanide concentration in-crease on an activated sludge system; and to report on the removal of cyanide and thiocyanate from both systems. While further investigation is in progress, the results from this study, to date, indi-cate that there are several advantages to the anoxic/oxic system over the activated sludge system in handling cyanide, thiocyanate laden phe-nolic wastewater. Specific conclusions are: (1) cyanides and thiocyanates are effectively removed in both the activated sludge system and the anoxic/oxic system in the presence of up to 45 mg/ anoxic/oxic system in the presence of up to 45 mg/ L CN(-); (2) overall TOC removal is consistent in L CN(-); (2) overall TOC removal is consistent in both systems; (3) The anoxic/oxic system reacts better to changes in cyanide concentration changes than does the activated sludge unit; and (4) the anoxic/oxic system also has an added advantage over the activated sludge system in terms of am-monia-nitrogen removal. It is possible to reduce ammonia-nitrogen to nitrogen gas. (See also W89-02267) (Lantz-PTT)

W89-02298

PARTITIONING OF TOXIC ORGANIC COM-POUNDS ON MUNICIPAL TREATMENT PLANT SOLIDS,

Environmental Protection Agency, Cincinnati, OH. Water Engineering Research Lab. R. A. Dobbs, M. Jelus, and K. Y. Cheng.

IN: International Conference on Innovative Biological Treatment of Toxic Wastewaters. June 24-26, 1986, Arlington, Virginia. April 1987. p 585-601, 5 fig, 4 tab, 22 ref.

Descriptors: *Organic compounds, *Municipal wastewater, *Wastewater treatment, *Toxic wastes, *Partitioning, Separation, Kinetics, Industrial wastewater, Sludge digestion, Sorption,

Preliminary studies have shown that partitioning on municipal wastewater treatment plant solids was not affected by solids-to-liquid ratio. Kinetic data on sorption of toxic organic compounds on wastewater treatment plant solids showed an initial rapid uptake followed by a slower rate over an extended period of time. Freeze-fried solids did not exhibit the same sorption characteristics as viable biomass. A correlation between sorption of toxic organics on wastewater treatment plant solids and octanol/water partition coefficient has been established. The relationship should be useful for estimating the removal of toxic organic compounds in municipal and industrial wastewater treatment plants by the sorption mechanism. The correlation also provides a basis for predicting concentrations of toxic compounds in various sudges provided the equilibrium concentration in the aqueous phase is known (or assumed). (See also W89-02299 W89-02299

PATAPSCO WASTEWATER TREATMENT PLANT TOXICITY REDUCTION EVALUA-

Engineering-Science, Fairfax, VA.
J. A. Botts, J. W. Braswell, E. C. Sullivan, W.
Goodfellow, and B. D. Sklar.

Its: International Conference on Innovative Biological Treatment of Toxic Wastewaters. June 24-26, 1986, Arlington, Virginia. April 1987. p 602-622, 4 fig. 5 tab, 9 ref.

Descriptors: *Toxic wastes, *Wastewater treat-ment facilities, *Baltimore, *Toxicity, *Water pol-lution control, Maryland, Municipal wastewater, Wastewater management, Chemical oxygen demand, Biological oxygen demand, Performance evaluation, Mixed liquors, Suspended solids.

The EPA and the City of Baltimore are conductring a Toxicity Reduction Evaluation (TRE) at the City's Patapsco Waste Water Treatment Plant (Patapsco WMTP). The Patapsco TRE was initiated in April 1986 and will provide the first case history tapsco WWTP). The Patapsco TRE was initiated in April 1986 and will provide the first case history of a toxics management program at a municipal wastewater treatment plant. The overall approach and specific tasks that have been developed since the TRE was proposed are described. Initial results of the study are also presented and discussed. The evaluations performed to date of the historical data demonstrate that the pass-through of toxicity at the Patapsco WWTP can be related in part to plant performance and operating conditions. Effluent toxicity was correlated with reduced plant performance (e.g., BOD and COD removal) and operation of the plant outside of the design food:ratio. Although the historical influent data (i.e., BOD, COD, SS and toxicity) were not found to be related to effluent toxicity, recent dat that account for the HRT of the wastewater will be used to revaluate this relationship. The evaluation of plant performance during toxic events found additional evidence for the relationship of plant performance to toxicity pass-through. Effluent toxicity appeared to be related to influent toxicity, MLSS concentration and COD removal. However, it was not determined whether wastewater toxicity was a result of poor performance or vice versa. (See also W89-02267) (Lantz-PTT) W89-02300

MICROTOX ASSESSMENT OF ANAEROBIC BACTERIAL TOXICITY,
Massachusetts Univ., Amherst. Dept. of Civil En-

D. S. Atkinson, and M. S. Switzenba

D. S. Atkinson, and M. S. Switzenbaum.

IN: International Conference on Innovative Biological Treatment of Toxic Wastewaters. June 24-26, 1986, Arlington, Virginia. April 1987. p 623-642, 3 fig., 5 tab, 55 ref. Massachusetts Division of Water Pollution Control Contract 83-31.

Descriptors: *Toxic wastes, *Wastewater treatment, *Toxicity, *Microtox, *Bacteria, Economic aspects, Bioassays, Anaerobic treatment, Monitoring, Inorganic compounds, Sludge.

ing, Inorganic compounds, Sludge.

The anaerobic toxicity assay (ATA) is currently one of the more widely used methods of determining anaerobic toxicity. The ATA is a batch method which measures the adverse effect of a substance or mixture on the rate of methane production from an easily degraded methanogenic substrate. While this method is simple and relatively inexpensive, it is time consuming, requiring up to two weeks before results are available. The Microtox toxicity analyzer provides a means for rapid, inexpensive assessment of toxicity of aqueous samples. The Microtox system is a relatively inexpensive test which employs aerobic bioluminescent marine bacteria (Photobacterium phosphoreum) and can yield reproducible results within one hour. The primary objective of this research has been to determine whether the Microtox system can be used as a suitable surrogate test for the longer ATA test. Results do not indicate that Microtox would be expected to serve as a particularly good surrogate for the ATA to be used for monitoring potentially toxic wastes entering an anaerobic treatment unit. The Microtox may have an application for monitoring waste streams which may be subject to inorganic toxicants but are unlikely to be contaminated with organic toxicants. The work presented in this paper has been directed at evaluating the toxicity of pure compounds. Studies on toxified sludges would help in further evaluating the Microtox as a surrogate for the ATA. (See also W89-02267) (Lantz-PTT) W89-02301

RESPIRATION-BASED EVALUATION OF NI-TRIFICATION INHIBITION USING RICHED NITROSOMONAS CULTURES,

Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 7B.
W89-02302

ASSESSMENT OF THE DEGREE OF TREAT MENT REQUIRED FOR TOXIC WASTEWATER EFFLUENTS,

WASLEWAIER EFFLUENTS, New Jersey Inst. of Tech., Newark. Dept. of Civil and Environmental Engineering. G. F. Lee, and R. A. Jones. IN: International Conference on Innovative Bio-logical Treatment of Toxic Wastewaters. June 24-26, 1986, Arlington, Virginia. April 1987. p 652-677, 26 ref.

Descriptors: *Toxic wastes, *Wastewater treatment, *Toxicity, Costs, Economic aspects, Hazardous wastes, Water quality, Public health, Waste management, Water quality control.

The amount of treatment that will be required for a particular wastewater (domestic, industrial, or hazardous waste) and the assessment of the adequacy of treatment provided are now coming to be con-trolled by the amounts of contaminants allowable trolled by the amounts of contaminants allowable without adversely affecting the aquatic life-related or public health-related beneficial uses of the receiving water. These concerns will in some instances dictate the type of treatment processes that must be used to achieve the desired degree of treatment as well as the siting of the treatment facilities. The EPA has recommended an approach that is designed to begin to address the evaluation and testing issues pertinent to this type of effluent evaluation approach. While there are a number of significant problems with the implementation of this approach in providing cost-effective treatment

Group 5D—Waste Treatment Processes

which will still provide adequate environmental which will still provide adequate environmental and public health protection in receiving waters, it does represent a significant step toward this regulatory agencies developing technically defensible control programs for toxics. Following the current (September 1985) EPA guidance may result in a dischargers treating an effluent to a considerably greater degree than necessary to provide protection of aquatic life-related beneficial uses of the receiving water, or inadequate treatment to achieve this protection. However, using this approach as a starting point, and building on it with proach as a starting point, and building on it with site-specific hazard assessment studies will likely be highly cost-effective in developing workable efflu-ent restrictions that provide adequate aquatic life-related beneficial use protection and also insure that money spent for toxic control will improve the water quality of the receiving waters. (See also W89-02267) (Lantz-PTT) W89-02303

8TH AESF/EPA CONFERENCE ON POLLU-TION CONTROL FOR THE METAL FINISH-

American Electroplaters and Surface Finishers Society, Orlando, FL. For primary bibliographic entry see Field 5G. W89-02392

HAZARDOUS WASTE RESEARCH PERTAIN-ING TO METAL FINISHING.

Protection Agency, Cincinnati, For primary bibliographic entry see Field 5G. W89-02393

PILOT SCALE RESULTS OF METAL VALUE RECOVERY FROM MIXED METAL HYDROX-IDE SLUDGES,

IDE SLUDGES,
Montana Coll. of Mineral Science and Technology, Butte. Dept. of Metallurgical and Mineral Processing Engineering.
L. G. Twidwell, D. R. Dahnke, W. L. Huestis, J. P. Quinn, and P. G. Comba.
IN: 8th AESF/EPA Conference on Pollution Control for the Metal Finishing Industry. EPA Report No. EPA/600/9-87/012, July 1987. p 13-47, 19 fig, 6 tab, 11 ref. EPA Grant CR-812533-01.

Descriptors: *Metal-finishing wastes, *Waste recovery, *Wastewater treatment, *Sludge, Metals, Heavy metals, Iron, Chromium, Economic aspects, Copper, Nickel, Zinc, Pilot plants, Chemical pre-cipitation, Chemical treatment.

Metal finishing hydroxide sludge materials are produced as a result of pollution control technology to remove heavy metal contaminants from electro-plating spent electrolytes and rinse waters. The present study was initiated to investigate an alternative and potentially more cost-effective way for removing iron and recovering chromium from mixed metal solution. Flowsheet results presented, illustrate that metal values can be recovered from electroplating and electromachining sludge waste materials. The major advantages of using phosphate precipitation over other possible separation unit operations are the simplicity of the precipita-tion and the ease of solid/liquid separation. A first order economic analysis is presently being per-formed for a flowsheet to treat fifty tons of sludge/ formed for a flowsheet to treat fifty tons of sludge/day of a copper-iron-chromium-zinc-nickel composite material. The unit operations involved in the analysis consists of: copper solvent extraction to produce crystalline copper sulfate; iron removal by phosphate precipitation; chromium removal by phosphate precipitation; zinc solvent extraction to produce crystalline zinc sulfate; nickel removal by carbonate precipitation; recycle of a portion of the final solution as make-up water and treatment of the remainder of the solution by evaporation and recycle to the leach operation. (See also W89-02392) (Lantz-PTT) W89-02394

PLATING WASTE SLUDGE METAL RECOV-

Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD.

D. E. Renard.
IN: 8th AESF/EPA Conference on Pollution Control for the Metal Finishing Industry. EPA Report No. EPA/600/9-87/012, July 1987. p 48-53, 5 ref.

Descriptors: *Wastewater treatment, *Electroplating, *Sludge, *Waste recovery, *Chemical treatment, *Heavy metals, Metal-finishing wastes, Costs, Sulfuric acid, Nickel, Copper, Zinc, Iron, Chromium, Chemical precipitation.

Army depot electroplating shops are facing increased costs for metal-bearing sludge disposal; metals extraction offers the potential for resource recovery and simplified sludge disposal. Sulfuric acid leaching of a prepared plating sludge is effective in short contact time, about 30 minutes, in effecting > 99% recovery of copper, chromium, nickel, zinc, and iron and > 97% recovery of cadmium in the leach liquor. Under the leaching conditions employed, rendering the residual filter cadmium in the leach liquor. Under the leaching conditions employed, rendering the residual filter cake into compliance as non-hazardous by the EPA leach test was not possible. However, the residual filter cake after sulfuric acid leaching can be made to meet non-hazardous criteria by blending 10% by weight of lime to the solids which are primarily calcium sulfate. Sulfide precipitation under controlled pH on the sulfuric acid leaching tiquors is effective in separating copper and cadmium quantitatively as sulfides from the chromium which remain in the solution. Zinc is nearly quantitatively precipitated, but nickel and iron are only partially removed. Further separation between iron and chromium is possible with a mixture of organic solvents. (See also W89-02392) (Lantz-PIT) W89-02395

TREATMENT OF AQUEOUS METAL BEAR-ING HAZARDOUS WASTES,
Environmental Protection Agency, Cincinnati,
OH. Hazardous Waste Engineering Research Lab.
D. W. Grosse, S. Q. Hassan, and J. E. Park.
IN: 8th AESF/EPA Conference on Pollution
Control for the Metal Finishing Industry. EPA
Report No. EPA/600/9-87/012, July 1987. p 5467, 3 fig, 8 tab, 5 ref.

Descriptors: *Hazardous wastes, *Wastewater treatment, *Metal-finishing wastes, Industrial wastewater, Heavy metals, Chemical precipitation, Nickel, Activated carbon, Adsorption, Perform-

Research being conducted at U.S. EPA's Test and Evaluation Facility involves treatment of metal finishing hazardous wastewaters. A variety of unit treatment processes have been fabricated to offer BDAT (Best Demonstrated Available Technology) in treating hazardous, aqueous metal waste streams. These unit processes include lime precipitation, flocculation, clarification, sulfide precipita-tion, mixed media filtration, ion exchange, and granular activated carbon adsorption. The results gramular activated carbon assorption. The results of the first three test runs are presented. Sulfide precipitation exhibited greater metals removal potential over lime precipitation. Complexed nickel proved to be more difficult to treat even after advanced treatment techniques of ion-exchange and activated carbon adsorption. (See also W89-02392) (Lantz-PTT) W89-02396

WHY NOT SIMPLIFY WASTEWATER COM-

Unocal Corp., Brea, CA. Applied Technology

Oroup.

D. T. Walker.

IN: 8th AESF/EPA Conference on Pollution
Control for the Metal Finishing Industry. EPA
Report No. EPA/600/9-87/012, July 1987. p 68-76, 3 fig, 1 tab.

Descriptors: *Chemical treatment, *Wastewater treatment, *Iron, *Chemical precipitation, UNI-PURE Process Technology, Heavy metals, Metal-finishing wastes, Industrial wastewater, Performance evaluation.

The Clean Water Act imposes rigorous restrictions on the amount of contaminants left in discharged

waters. This Act requires industry not only to neutralize wastewaters but to remove toxic heavy metals from their wastewaters. Removing heavy metal contaminants from wastewater is not always easy or even possible using conventional methods. A new method is based on the solubility of a single element, fron, rather than the individual solubilities of the various toxic heavy metals. The process is desired to estimate the irror in the sustantiate. designed to activate the iron in the wastewater. When properly activated, iron is capable of binding soluble toxic heavy metals. The iron may then be taken out of solution, with the heavy metals still be taken out of solution, with the heavy metals still bound to it, in such a way as to encapsulate the metals and isolate them from the solution. The flexibility of this new technology permits a free choice of neutralizing base (including ammonia). This new iron coprecipitation-encapsulation process has been proven in bench-scale laboratory testing, automated pilot units and actual commercial application. (See also W89-02392) (Lantz-PTT) W89-02397

HOWARD PLATING CLEAN UP THEIR ACT WITH MAGNESIUM HYDROXIDE,

Howard Plating Industries, Madison Heights, MI. G. W. Louchart.

IN: 8th AESF/EPA Conference on Pollution Control for the Metal Finishing Industry. EPA Report No. EPA/600/9-87/012, July 1987. p 122-130, 1 fig. 1 tab

Descriptors: *Chemical treatment, *Wastewater Descriptors: "Chemical treatment, "Wastewater treatment, "Electroplating, "Magnesium hydrox-ide, "Water pollution control, Heavy metals, Zinc, Iron, Chromium, Manganese, Copper, Nickel, Lead, Water quality control, Sludge, Bases.

An electroplating plant located in the metropolitan Detroit suburb of Madison Heights, provides metal finishing services for the automotive industry, em ploying nearly 250 full-time workers. The total wastewater effluent from the metal finishing procwastewater terment from the metal minsting processes amounts to 0.4 million gaillons per day. Significant concentration of dissolved zinc, iron and chromium and minor concentrations of nickel, copper, lead, manganese and cadmium are present. These wastewaters are neutralized with magnesi-um hydroxide and caustic soda in order to precipi-tate the dissolved metals, as hydroxides, for even-tual collection in a plate and frame filter press. The addition of magnesium hydroxide to the wastewater treatment process has demonstrated the benefits of reduced chemical consumption, im-proved sludge handling, reduced maintenance re-quirements, and improved water quality. The use wastewaters are neutralized with magnesiof magnesium hydroxide is highly recommended for batch treatment systems. Although the efficient for oatch treatment systems. Authough the efficient use of this product in a continuous flow system may be more difficult to achieve, its usage should be investigated as an alternative to other alkali sources because of these significant benefits. (See also W89-02392) (Lantz-PTT)

METAL FINISHING WASTEWATER TREAT-MENT UPGRADE WITH AN INSOLUBLE SULFIDE PRECIPITATION PROCESS,

R. V. Bazza, C. M. Kelleher, and M. B. Yeligar. IN: 8th AESF/EPA Conference on Pollution Control for the Metal Finishing Industry. EPA Report No. EPA/600/9-87/012, July 1987. p 131-149, 3 fig, 5 tab, 7 ref.

Descriptors: *Metal-finishing wastes, *Wastewater treatment, *Chemical precipitation, Chemical treatment, Sulfides, Clarification, Wastewater facilities, Filtration, Pilot plants.

Pilot testing, toxicity testing and operating cost evaluations should that an upgrade of an existing wastewater treatment system should include insoluble sulfide precipitation as an advanced treatment process in order to meet new NPDES Permit requirements. Final design of the wastewater treatment upgrade has been completed. The design has taken into account licensing considerations, system ment upgraue mas been completed. Ine design has taken into account licensing considerations, system maintainability and reliability, and the owner's commitment to total compliance with all local, state and federal environmental codes. The advanced treatment plant will include a new 10,000

Waste Treatment Processes—Group 5D

so ft building addition which will house two 300 gallon per minute equipment trains consisting of inclined plate clarifier/thickeners, sludge blanket precipitators, dual media filters and chemical feed systems. The treatment system will also include two new 250,000 gallon holding/equalization tanks to receive flow from the existing treatment plant before the wastewater is directed to the new advanced treatment system. The new treatment plant is currently under construction. Startup is expected in mid-1987. (See also W89-02392) (Lantz-PTT) in mid-150. W89-02402

PERFORMANCE OF ANALYTICAL TEST KITS ON METAL FINISHING WASTEWATER SAM-

Scientific Control Labs., Inc., Chicago, IL

IN: 8th AESF/EPA Conference on Pollution Control for the Metal Finishing Industry. EPA Report No. EPA/600/9-87/012, July 1987. p 150-180, 23 tab.

Descriptors: *Wastewater treatment, *Water anal-ysis, *Metal-finishing wastes, *Water pollution control, *Industrial wastewater, Testing proce-dures, Heavy metals, Copper, Zinc, Cadmium, Lead, Nickel, Chromium, Fluoride, Cyanide, Hy-drogen ion concentration, Performance evaluation.

Stringent Federal Pretreatment Regulations and NPDES Permit Requirements have created a need for close, constant monitoring of the pollutant concentrations of metal finisher's effluents. Many large shops have invested the large sums of money re-quired to construct analytical laboratories sophisti-cated enough to perform analytical monitoring using EPA approved procedures. Other metal fin-ishers have resorted to the use of inexpensive test kits for monitoring their discharge. There are nu-merous suppliers of these kits and their number is expanding. The capabilities and ease of use of the most widely publicized kits were compared with the EPA approved methods of analysis. For each analytical procedure, an attempt was made to incentrations of metal finisher's effluents. Many large analytical procedure, an attempt was made to in-clude a variety of metal finishing sources that would have an effluent containing the parameter under consideration in concentrations below or near the Federal Pretreatment Guidelines. The near the Federal Pretreatment Guidelines. The study concentrated on test kits often used in compliance monitoring by metal finishers. The test kits evaluated were for the determination of heavy metals (Cu, Zn, Cd, Pb, Ni, total and heavalent Cr), cyanide, fluoride, pH, and total phosphorus. The kits evaluated in this study frequently were unable to accurately analyze a wide variety of metal-finishing discharges. No one manufacturer provided kits that performed best on all parameters. It is apparent that the metal finisher must establish correlation between the analytical results obtained with the kits and accented EPA analytiobtained with the kits and accepted EPA analytical procedures. (See also W89-02392) (Lantz-PTT) W89-02403

APPLICATION OF STATISTICAL PROCESS CONTROL TO WASTEWATER PRETREAT-

MENT, Superior Metal Products, Lima, OH. R. S. J. Naguit. IN: 8th AESF/EPA Conference on Pollution Control for the Metal Finishing Industry. EPA Report No. EPA/600/9-87/012, July 1987. p 181-197, 20 fig. 3 tab.

Descriptors: *Pretreatment of wastes, *Wastewater treatment, *Statistical studies, *Process control, *Metal-finishing wastes, Electroplating, Costs,

With the increasing complexities of the EPA regu-lations and the inherent associated compliance costs, the need to apply statistical process control to manage the wastewater pretreatment operations to manage the wastewater pretreatment operations in the metal-finishing industry is more crucial now that it has ever been. Today, there is wide agreement that continual improvement in quality and cost is not only possible but also realistic and necessary. It is shown that those goals may be pursued in concert, that they are not in opposition. The key is the application of Statistical Process Control (SPC) to manage a business operation or a

process. The following are the benefits derived from the use of SPC in Wastewater pretreatment: For the company, it triggers a positive chain reaction involving better understanding of the process, better effluent quality, EPA compliance, lower cost, stronger competitive position, and greater market share. For the community, the better quality of the effluent from the referenteet facility. market share. For the community, the oeter quaitity of the effluent from the pretreatment facility translates into better quality of the influent to the local publicly owned treatment works, which would mean less treatment cost. (See also W89-02392) (Lantz-PTT)

WASTE WATER REDUCTION IN METAL FAB-RICATIONS OPERATIONS, Du Pont de Nemours (E.I.) and Co., Aiken, SC.

Ear Foil us Nemours (E.I.) and Co., Aiken, SC. Savannah River Plant.
H. L. Martin, P. K. Gurney, and L. P. Fernandez.
IN: 8th AESF/EPA Conference on Pollution Control for the Metal Finishing Industry. EPA Report No. EPA/600/9-87/012, July 1987. p 198-213, 7 fig. 4 tab.

Descriptors: *Groundwater pollution, *Cleanup operations, *Wastewater treatment, *Water quality control, *Metal-finishing wastes, Industrial wastewater, Monitoring, Wastewater analysis, Design criteria, Savannah River Plant, South Carolina.

The Savannah River Plan produces special nuclear materials for the U.S. Government. Since 1958, chemical wastes generated by an aluminum form-ing/metal finishing process used to manufacture ing/metal finishing process used to manufacture fuel and target assemblies were discharged to a settling basin. This process waste stream contained acids, hydroxides, metal oxides, and chlorinated degreasing solvents. In 1981, trichloroethylene and tetrachloroethylene were discovered in monitoring wells near the settling basin. In November 1983, a federal law mandated that discharges to the basin be stooped within two years. A remedial action be stopped within two years. A remedial action program to remove the solvents from the groundwater and to close the settling basin was promptly implemented. Installation of a wastewater treatimplemented. Installation of a wastewater treatment facility was required before basin closure. This required an accelerated program of process development to provide basic data for design. Wastewater from 87% process effluents totaled 528 gpm. A high spot venture guidance appraisal indicated that each gallon per minute reduction in wastewater flow would reduce the capital cost of the treatment facility by \$10,000. An engineering consulting firm was quickly selected, and their laboratory was assembled on site for an effluent characterization and flow reducts as well as drag out sition of spent process solutions as well as drag out from each process solution to rinse water were then measured. Optimum combinations of counterthen measured. Optimum combinations of counter-flow rinse determined for each production oper-ation. In addition, a quench water treatment system was developed to remove emulsified oil and carbon and to recycle the effluent of that unit operation. The study indicated that inplant modifi-cations could greatly reduce the total wastewater cations could greatly reduce the total wastewater effluent, thus reducing the size of the wastewater treatment facility and reducing overall program costs. A composite sample of the projected wastewater after flow reductions was used in treatability tests to develop the flowsheet for the treatability test to develop the flowsheet for the treatability and to provide basic data for design. The wastewater flow reduction up to 20 gpm was achieved and the treatment facility was represent and the treatment facility was successfully started up in July 1985. (See also W89-02392) (Author's abstract)

WASTEWATER TREATMENT: OPTIMIZING

AN EXISTING SYSTEM, Harris Corp., Melbourne, FL. K. O. Gill.

K. O. Gill.
IN: 8th AESF/EPA Conference on Pollution Control for the Metal Finishing Industry. EPA Report No. EPA/600/9-87/012, July 1987. p 214-235, 11 fig, 8 tab, 5 ref.

Descriptors: *Wastewater treatment, *Management planning, *Operations, *Optimization, Wastewater management, Monitoring, Costs, Computer programs

A logical and methodical approach to plant prob-lem-solving exercises and cost-reduction can be of tremendous benefit to plant personnel in any en-deavor to optimize an existing wastewater treat-ment plant. The causes of treatment problems must be efficiently isolated using an established sampling plan and analytical procedures, and operators must have appropriate monitoring parameters available to them to ensure that wastewater quality continu-ously meets applicable limits. Manipulation of available plant operating data will highlight less obvious solutions. Inexpensive and readily availavailable plant operating data will highlight less obvious solutions. Inexpensive and readily available software can automate many basic plant functions, saving operator time, producing much more consistent results in effluent quality, and providing a simple tracking mechanism for everything from operating costs to spare parts and equipment inventory. (See also W89-02392) (Lantz-PTT)

ELECTROLYTIC RECOVERY THEORY, APPLICATION, ADVANTAGES,

Baker Brothers/Systems, Stoughton, MA. D. Bailey, and M. Chan.

IN: 8th AESF/EPA Conference on Pollution Control for the Metal Finishing Industry. EPA Report No. EPA/600/9-87/012, July 1987. p 236-247, 7 fig. 11 ref.

Descriptors: *Waste recovery, *Metal recovery, *Wastewater treatment, Electrowinning, *Electrolysis, Recycling, Regulations, Heavy metals.

The theoretical electrochemical basis of electrolytic recovery of metals is reviewed, including potential and current and mass transfer. Classical versus tial and current and mass transfer. Classical versus high rate electrowinning is explained and the characteristics of carbon-fiber electrowinning are described. Electrowinning is the extraction of metals from solution under the influence of an applied current. No treatment chemicals are necessary to carry out this process. The only consumable required is electricity. To produce one pound of metal it normally takes 3 to 4 KwH of electricial power. In most cases the electricity cost is officed. power. In most cases the electricity cost is offset by the value of the recovered metal. In adition to the benefits of low operational cost and a positive the benefits of low operational cost and a positive return on investment, the system generates no sludge and, therefore, eliminates the permanent liaility of sludge disposal. Labor cost is also consid-erably reduced to a great extent by deleting the necessity of sludge and chemical handlings. All these substantial savings, tangible and intangible, lead to a very attractive payback period even for the recovery of the less expensive metals. The carbon fiber electrowinning technique has successrolly demonstrated a new perspective for today's pollution control philosophy. That is, to achieve the goal of full regulatory compliance by recovery and conservation of precious resources. (See also W89-02392) (Lantz-PTT) W89-02407

WASTE TREATMENT AND RECYCLING OF MIXED WASTEWATER FROM A METAL FINISHING COMPANY,

Aneptek Corp., Wayland, MA.

Niepiek Corp., wayland, 1972.

D. J. Lee.

IN: 8th AESF/EPA Conference on Pollution Control for the Metal Finishing Industry. EPA Report No. EPA/600/9-87/012, July 1987. p 248-256, 1 fig. 3 tab, 4 ref.

Descriptors: *Wastewater treatment, *Metal-finish-Descriptors: "Wastewater treatment," Metal-inusa-ing wastes, "Heavy metals, "Recycling, "Metal recovery, "Ion exchange, Nickel, Chromium, Copper, Cadmium, Zine, Regulations, Filtration, Carbon, Adsorption, Chemical precipitation, Chemical treatment, Water conservation, Waste minimization, Monitoring.

An electroplating shop in Providence, Rhode Island accepted a challenge to install a waste treat-ment system to remove pollutants from the rinse waters in their plating operations. The regulatory body, Narragansett Bay Commission (NBC), re-quires very stringent effluent standards effective in two tiers covering a time span of shorter than 18 months. The company, International Chromium Plating Company, does a variety of plating work

Group 5D-Waste Treatment Processes

including electroless nickel, bright nickel, chromi-um, acid copper, cadmium, zinc, and chromate conversion coating, etc. As a result, a variety of heavy metals and cyanides constitute the contami-nants in the rinse water. The objective of the waste nants in the rinse water. I no cojective of the wissic treatment project is to meet the discharge limita-tions required by the Narragansett Bay Commis-sion. Ion exchange (IX) was conceived as the work horse of the designed treatment system. The IX norse of the designed treatment system. The 1X system was to consist of a simple cation resin bed followed by a pH adjustment system. The selected IX system consists of the following: (1) cartridge filters; (2) carbon adsorption bed; (3) three-bed IX columns (consisting of strong acid cation, weak base anion and strong base anion resins); (4) precipitation hopper; (5) heat exchanger (to heat up caustic resequentle); (6) acid resequently westerns. capitation hopper; (3) heat accumage; to heat the caustic regenerate); (6) acid regenerat waste tank; (7) backwash tank; and (8) acid and caustic metering system. The strategies for successful employment of the IX system to achieve the goals include the following: constant improvement to reduce metal salts loading to the system by in-process recovery, waste minimization and water conservation; close monitoring of the system performance to prevent leaks; and flexibility of solids handling to free up the system for continuous operation. (See also W89-02392) (Lantz-PTT) W89-02408

SUCCESSFUL IN HOUSE RECOVERY OF

SOLVENT, Finish Engineering Co., Erie, PA. For primary bibliographic entry see Field 5G. W89-02410

CALPURNIA AND THE STRIP BARN, Naval Air Rework Facility, Cherry Point, NC. J. M. Freemon.

J. M. Freemon. IN: 8th AESF/EPA Conference on Pollution Control for the Metal Finishing Industry. EPA Report No. EPA/600/9-87/012, July 1987. p 290-292.

Descriptors: *Wastewater treatment, *Water quality control, *Phenols, Industrial wastewater, Aircraft, Stripping.

One of North Carolina's largest industrial produc-One of North Carolina's largest industrial production facilities performs depot-level maintenance on a variety of combat aircraft, engines, and components. In January 1984, a new permit was issued by the State of North Carolina with EPA having an overview responsibility. North Carolina insisted on tighter discharge parameters and began monitoring daily discharge reports. Historic industrial wastewater discharge records indicated average daily concentrations of phenols of 55 ppm with a high of 150 ppm. A four-prong attack was launched to eliminate or dramatically reduce phenols in the industrial waste stream; (1) review and launched to eliminate or dramatically reduce phenols in the industrial waste stream: (1) review and tighten existing specifications covering aircraft paint stripping agents; (2) search-out-and-test-prove available nonphenolic stripping agents that protect the aircraft and perform efficiently without creating health hazards; (3) develop a program ultimately to eliminate all chemical stripping, and (4) review the criteria by which a decision is made to strip an aircraft before overhaul or repair. As part of this program, plastic media blasting was tested as a replacement of chemical stripping. Initial results were promising, changes in the criteria for stripping an aircraft cut in half the number needing phenolic stripping. (see also W89-02392) (Lantz-PPT)

METAL TREATMENT AND RECOVERY, Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering. J. W. Patterson.

In: Metal Speciation: Theory, Analysis and Application. Lewis Publishers, Chelsea, Michigan. 1988. p 333-345, 8 fig, 1 tab, 6 ref.

Descriptors: *Chemical recovery, *Metals, *Trace metals, *Sludge conditioning, *Chemistry of precipitation, Sludge utilization, Sludge, Nucleation.

Increasingly restrictive industrial wastewater disnitations, escalating costs of wastewater

treatment process sludge disposal, and future liability associated with traditional sludge disposal methodologies have contributed to renewed interity associated with traditional sludge disposal methodologies have contributed to renewed interests in more effective and alternative methods of metals management. Alternative methodologies are predominantly focused on opportunities for metals recovery, and include selective sorption/desorption, differential precipitation, and sludge beneficiation and extraction. An understanding for metal speciation is essential to understanding how to control metal chemistry for treatment and recovery. Speciation encompasses both soluble species and solid salts formed in the precipitation process. Recent research on the morphology of metal precipitates, and on the extent to which precipitate characteristics can influence coprecipitation are reported. As demonstrated by the data presented, there are techniques to rapidly assess the accuracy of prediction in terms of the solid phase anticipated and the applicability of thermodynamic reaction constants. For metal salts precipitation, the research was concerned with nucleation and crystal growth, and how solution chemistry and the mode of induction of supersaturation influences the characteristics of the precipitate solids formed. (See also W89-02640) (VerNooy-PTT)

ECONOMIC AND ENVIRONMENTAL IM-PACTS OF USING MUNICIPAL SEWAGE EF-FLUENT FOR AGRICULTURAL PRODUC-

TION, Oklahoma State Univ., Stillwater. Dept. of Agri-For primary bibliographic entry see Field 5E. W89-02663 cultural Economics

REGULATION OF THE AGRICULTURAL UTI-LIZATION OF SEWAGE SLUDGE IN NEW

JERSEY, New Jersey Dept. of Environmental Protection, Trenton. Residuals Management Section. For primary bibliographic entry see Field 5E. W89-02676

WASTEWATER CHARACTERIZATION AND HAZARDOUS WASTE SURVEY, CASTLE AFB,

CA,
Air Force Occupational and Environmental
Health Lab., Brooks AFB, TX.
C. W. Attebery, R. A. Tetla, and R. D. Binoyi.
Available from the National Technical Information
Service, Springfield, VA. 22161, as ADA182481.
Price codes: A03 in paper copy, A01 in microfice.
May 1987. Final Report. 41p, 4 fig, 5 tab, 6 ref, 4
append. annend.

Descriptors: *Wastewater treatment, *Hazardous wastes, *Castle Air Force Base, California, Wastewater management, Industrial wastewater, Spray irrigation, Separation, Solvents, Hydrocarbons, Radioactivity.

The US Air Force Occupational and Environmental Health Laboratory (USAFOEHL) conducted a survey evaluating the industrial wastewater system and hazardous waste program at Castle AFB. Results of the survey showed: (1) The spray irrigation system works wall, waster entering the decision sults of the survey showed: (1) The spray irrigation system works well, water entering the drainage ditch prior to Canal Creek contains relatively low concentrations of NPDES parameters; (2) Three separators and two sums were found to contain characteristic hazardous waste; (3) The base has virtually no baseline chemical analysis to characterize waste streams, consequently, most waste streams are classified hazardous waste without documented rationale; (4) Opportunities exist to reduce quantities of waste in the following categories: rinsewater, solvents, sewage treatment and acids. Recommendations for improvement are discussed, and include: (1) cleaning out some of the separators; (2) Developing a comprehensive waste cussed, and include: (1) cleaning out some of the separators; (2) Developing a comprehensive waste analysis plan and hazardous waste training and educational program; (3) Procure a small solvent recovery unit for waste methyl ethyl ketone for a Corrosion Control Paint Shop; (4) Reevaluate the service requirements for each Safety Kleen unit to ensure the base is not paying for the disposal of 'clean' solvent; (5) Sample Industrial Waste Treatment effluent for 40 CFS 261, Appendix IX select-

ed parameters; (6) Resample sludge and include ed parameters; (6) Resample sludge and include moisture content as a test parameter; (7) Sample sludges from oil/water separators, sumps, and holdings, and analyze for hazardous waste charac-teristics; and (8) Resample drainage ditch influent and effluent, and aeration pond effluent for volatile hydrocarbons, bacteria (fecal streptococci and fecal coliform), and radioactivity. (Lantz-PTT) W89-02704

SUPERFUND RECORD OF DECISION: ROCK-AWAY BOROUGH WELL FIELD, NJ.

AWAY BOROUGH WELL FIELD, NJ.
Environmental Protection Agency, Washington,
DC. Office of Emergency and Remedial Response.
Available from the National Technical Information
Service, Springfield, VA. 22161, as PB87-189353.
Price codes: A04 in paper copy, A01 in microfiche.
Report EPA/ROD/R02-86/034, September 1986.

Descriptors: *Water pollution treatment, *Rockaway Borough Well Field, *Water treatment, *Groundwater pollution, *New Jersey, Trichloroethylene, Pollutant identification, Activated carbon, Tetrachloroethylene, Organic compounds, Feasibility studies, Remedies, Costs.

The Rockaway Borough Well Field Site is located The Rockaway Borough Well Field Site is located in Rockaway Borough, Morris County, New Jersey, and consists of three municipal supply wells in a glacial aquifer designated by EPA as the sole source aquifer for Rockaway Borough and the surrounding communities. High concentrations of trichloroethylene (TCE) and tetrachloroethylene (PCE) have been detected in the aquifer since 1980, but no sources of contamination have been identified. In 1981, the Borough of Rockaway con-structed a three-bed granular activated carbon adsorption system to treat contaminated well water. Treatment has effectively reduced volatile organic Treatment has effectively reduced volatile organic contaminant concentrations in finished water to < 1 ppb. Although thirteen VOCs have been detected in the well water, TCE and PCE are the primary contaminants of concern. The site was listed on the National Priority List in December of 1982, and the Remedial Investigation/Feasibility Study (RI/FS) was initiated in 1985. The selected grantial action for the Rockaway Records site. Study (RI/FS) was initiated in 1985. The selected remedial action for the Rockaway Borough site includes: Rockaway Borough maintaining the existing filtration system and modifying operations to ensure compliance with Safe Drinking Water Act standards; and EPA continuing the RI/FS in an attempt to identify the source and extent of contamination and evaluate additional remedial action alternatives to address source control. Estimated capital cost of this remedial action is zero with annual operations and costs maintenance of \$74,800. (Author's abstract) W89-02706

SUPERFUND RECORD OF DECISION: COMBE FILL NORTH LANDFILL, NJ. Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response. For primary bibliographic entry see Field 5G. W89-02707

CONTRIBUTION TO COMPUTATION OF SEDIMENTATION OF SOLIDS IN HORIZON-TAL-SEDIMENTATION BASINS (EIN BEITRAG ZUR BERECHNUNG DER SEDIMENTATION VON FESTSTOFFEN IN HORIZONTAL DURCHSTROMTEN SANDFANGEN),

Hochschule der Bundeswehr Muenchen, Neubi-berg (Germany, F.R.). Inst. fuer Wasserwesen. W. Schrimpf.

w. Schmip.
Available from the National Technical Information Service, Springfield, VA. 22161, as DE87-770165. Price codes: Al 0 in paper copy, A01 in microfiche. 1987. 280p, 133 fig. 14 tab, 130 ref. English summary. Mittellungen des Instituts fuer Wasserwesen der A10 Hochschule der Bundeswehr Muenchen,

Descriptors: *Sedimentation, *Settling basins, *Wastewater treatment, Hydraulic models, Hydrodynamics, Mathematical models, Suspended sedi-ments, Model studies, Aeration chambers.

Waste Treatment Processes—Group 5D

A diffusion-convection type equation was applied for the mathematical modelling of the settling behavior of sand-sized in non-aerated sedimentation basins. Dimensioning diagrams obtained by means of numerical solutions permit the design of the basins according to the input parameters and the boundary conditions. A sensitivity analysis reveals boundary conditions. A sensitivity analysis reveals that it is not possible to predict an exact value, and the results of sedimentation tests in a laboratory flume agree. Sedimentation of solids was also studied in aerated basins made of finished graduated tubes. Experiments with two-dimensional models showed that air-flow rate, water depth, and aerator. position were the most important quantities. Sedi-mentation tests in a three-dimensional physical model proved the usefulness of this type of aerated model proved the usefulness of this type of aerated chamber, although it is not yet in use in West Germany. In particular, a variable air-flow rate will fulfill two requirements: separation of organic and inorganic matter and high removal ratio of inorganic solids. Different tube sizes (length and diameter) lead to flexible peration at various sewage inflows. (Lantz-PTT) W89-02711

WASTEWATER TREATMENT: OZONATION PROCESSES AND EQUIPMENT. CITATIONS FROM THE SELECTED WATER RESOURCES ABSTRACTS DATABASE (JAN 77 - AUG 37). National Technical Information Service, Springfield. VA

nicid, VA. Available from the National Technical Information Service, Springfield, VA. 22161, as PB87-866232. Price codes: N01 in paper copy, N01 in microfiche.

Descriptors: *Wastewater treatment, *Ozonation, *Bibliographies, Literature review, Disinfection, Chlorination, Kinetics, Chemical treatment, Water supply, Water quality control.

This bibliography contains citations concerning the utilization of ozonation processes for wastewater disinfection. Topics include system descriptions and evaluations, comparisons with the chlorination process, reaction kinetics, and the use of the process in combination with other wastewater treatment methods. The treatment of organic and inorganic compounds in wastewater and municipal water supplies is discussed. This updated bibliography contains 228 citations (47 of which are new entries). (Author's abstract)

PRETREATMENT IN CHEMICAL WATER AND WASTEWATER TREATMENT. For primary bibliographic entry see Field 5G. W89-02791

PRETREATMENT OF INDUSTRIAL WASTEWATER: LEGAL AND PLANNING AS-PECTS-A CASE STUDY, Karlsruhe Univ. (Germany, F.R.). Inst. fuer Sied-

lungswasserwirtschaft. H. H. Hahn, and K.-H. Hartmann.

Wastewater Treatment. Springer-Verlag, New York. 1988. p 125-137, 5 fig, 4 tab, 5 ref.

Descriptors: *Wastewater treatment, *Industrial wastewater, *Pretreatment of water, *Legal aspects, *Planning, *Water pollution prevention, Case studies, Administrative regulations, Sewer systems, Environmental protection, Tannery wastes, Chromium, Biological treatment, Nitrification, Sludge, Germany, Hazardous materials.

There are new administrative regulations in the Federal Republic of Germany that permit water authorities to demand industrial pretreatment such that the subsequent treatment of wastes in the central municipal plant may no longer be a problem in terms of waste load or treatability. These lem in terms of waste load or treatability. These new regulations and their effect is illustrated by discussion of one example of reorientation in com-bined industrial/domestic wastewater treatment. For the discharge of wastewaters into sewer sys-tems, state legislators are asked to request a treat-ment according to 'best available technology' if the sewage contains dangerous substances. The intent

is two-fold: (1) the protection of the aqueous envi-ronment is to be intensified; and (2) the regulations ronment is to be intensified; and (2) the regulations should serve as an incentive for the development of advanced technology in the area of avoiding the generation of wastes, in the field of treatment at the source, and in the area of wastewater treatment in general. The composition of the combined wastewater stream at the city of B. is complex, due to the large contribution from one dominating sector of industry—the leather industry. Various alternative concepts for the treatment of the city's industrial wastes were developed. The selection of a pre-precipitation and coagulation alternative was favored for the following reasons: (1) The biologifavored for the following reasons: (1) The biologi-cal-treatment stage is better protected from unforecar-treatment stage is better protected from unfore-seen fluctuations in the composition and quantity of the incoming wastewater; (2) nitrification will be slightly better in this alternative; and (3) the unusually large amount of biological sludge pro-duced will be less burdened with chromium due duced will be less burdened with chromium due its early removal. (See also W89-02791) (Shidler-PTT) W89-02800

CLEAN TECHNOLOGY IN THE NETHER-LANDS: THE ROLE OF THE GOVERNMENT. Rijksinstituut voor Zuivering van Afvalwater, Lelystad (Netherlands).

For primary bibliographic entry see Field 5G. W89-02801

SYNERGISTIC APPROACH TO PHYSICAL-CHEMICAL WASTEWATER PRETREATMENT IN THE FOOD INDUSTRY,

IN THE FOOD INDUSTRY, Ingenieurbuero fuer Verfahrenstechnik, Wiesbaden (Germany, F.R.). G. von Hagel. IN: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 151-158, 5 fig. 1 tab, 1 ref.

Descriptors: *Wastewater treatment, *Pretreat-Descriptors: "Wastewater treatment, "Pretreatment of water, "Physicochemical treatment, "Food-processing industry, "Food-processing wastes, Sewer systems, Anaerobic digestion, Chemical oxygen demand, Screens, Particle size, Chemical treatment, Flocculation.

More than 90% of the food industry's operations discharge their waters into the municipal sewer system. Only two methods of wastewater pretreatsystem. Only two methods of wastewater pretreatment are applicable to the food industry—anaerobic treatment, preferably at high chemical oxygen demand concentrations; and a combination of mechanical and physical/chemical methods, excluding adsorption. This paper focuses on the synergistic mechanical/physical/chemical approach. Screening of food-industry wastewaters with reliable fixed or movable fine screens has become the key step before chemical methods can be applied. Many wastewaters from the food industry cannot be readily used in chemical treatment without Many wastewaters from the food industry cannot be readily used in chemical treatment without screening because of the wide range of particle sizes of the solids they contain. The mechanical part of the pretreatment sequence not only reduces the amount of oxygen-consuming insoluble matter in the wastewater; it is the basic prerequisite for trouble-free economical application of subsequent flocculation/precipitation/plase-separation steps. The synergistic effect of the combined application of fine screening and chemical treatment is annied The synergistic effect of the combined application of fine screening and chemical treatment is applied now in an ever-increasing number of food processing plants. Surprisingly the time for the development of this trend was relatively short. (See also W89-02791) (Shidler-PTT) W89-02802

SEPARATION OF HEAVY METALS FROM EF-

SEPARATION OF HEAVY METALS FROM EF-FLUENTS BY FLOTATION, Thessaloniki Univ., Salonika (Greece). Lab. of General and Inorganic Chemical Technology. I. Zouboulis, and K. A. Matis. IN: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 159-166, 6 fig. 1 tab, 19 ref.

Descriptors: *Wastewater treatment, *Heavy metals, *Flotation, Ion flotation, Precipitate flotation, Adsorbing-colloid flotation, Surfactants, Chromium, Zinc, Lead, Copper, Arsenic.

Different flotation techniques suitable for separa-tion of heavy metals from effluent are described and potential applications of the processes are dis-cussed. 'lon flotation' involves the removal of surface-inactive ions from aqueous solutions by the addition of surfactants (or collectors) and the subaddition of surfactants (or collectors) and the sub-sequent passage of dispersed gas through the solu-tion. This technique has been applied in the labora-tory for removal of chromium and germanium. Raising the concentrations of the product to be removed may lead to precipitation before gas is passed into the solution; ion flotation carried out under these conditions is a form of 'precipitate flotation.' Precipitate flotation has been applied in the laboratory for the removal of zinc and lead as hydroxides, and copper and zinc as suffices. the laboratory for the removal of zinc and lead as hydroxides, and copper and zinc as sulfides. An advantage of precipitate flotation is that it does not require a stoichiometric ratio of reagents as ion flotation does; thus it is suitable for large-scale operations such as those required in wastewater treatment. 'Adsorbing-colloid flotation' generally involves the removal of a solute by adsorption on, or coprecipitation with, a carrier floc, which is then floated after the addition of a suitable surfact. This technique has been amplied in the laboratant. This technique has been applied in the labora-tory successfully for the removal of arsenic. It has also been used to process certain types of un-charged pollutants that are normally removed by coagulation or adsorption. (See also W89-02791) coagulation of (Shidler-PTT) W89-02803

PRETREATMENT OF WASTEWATER FROM THE AUTOMOBILE INDUSTRY.

Karlsruhe Univ. (Germany, F.R.). Inst. fuer Sied-R Klute

N. Ritue. In: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 167-177, 5 fig, 4 tab, 4 ref.

Descriptors: *Wastewater treatment, *Pretreatment of water, *Industrial wastes, *Automotive industry, Acidic water, Alkaline water, Chromium, Cyanide, Lacquer, Oil, Solvents, Regulations, Chemical precipitation, Flocculation.

There are five main types of wastewaters produced by the automobile industry: acidic/basic wastewaters; wastewaters containing chromium; those containing cyanide; those containing lacquer; and emulsions of grease, oil, and solvents in water. These effluents can cause operational interruptions in the central detoxification and neutralization plant of an automobile factory and reduce the level of purification. Due to changes in wastewater, law plant of an automobile factory and reduce the level of purification. Due to changes in wastewater law in Germany, stricter restrictions on the introduc-tion of wastewater from industry into lakes, rivers, and public wastewater treatment plants will be enforced. The interruption-free operation of the detoxification and neutralization plant is a prereq-uisite for the removal of dangerous substances in accordance with the new law. Accordingly, pre-treatment by chemical precipitation/flocculation of accordance with the new law. Accordingly, pre-treatment by chemical precipitation/flocculation of wastewaters containing lacquer was examined so that introduction of these wastewaters into the central wastewater treatment plant could proceed without difficulties. Jar tests showed that the chemically-oxidizable substances in these wastewaters could be eliminated up to 90% by adding appropriate amounts of aluminum and iron salts or lime. The addition of an organic floccula-tion aid improved the settling properties of the flocs and further increased elimination to 95%. These procedures for pretreating wastewaters con-taining lacquer have since been applied in an auto-mobile factory. Since then, operation of the central detoxification and neutralization plant has proceed-ed without interruptions. (See also W89-02791) (Shidler-PTT) W89-02804

INDUSTRIAL WASTEWATER PRETREAT-MENT OF A DENTAL-PHARMACEUTICAL COMPANY,

Wasserwirtschaftsamt Muenchen (Germany, F.R.).

wasserwirtschattsamt Muenchen (Germany, F.R.). F. W. Gunthert, and P.-M. Hajek. IN: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 179-187, 6 fig.

Group 5D—Waste Treatment Processes

Descriptors: *Wastewater treatment, *Industrial wastewater, *Chemical wastewater, *Pretreatment of water, *Pharmaceutical industry, Recreation, Sewer systems, Settling tanks, Neutralization, Water pollution prevention, Germany.

The wastewater in the catchment of Lake Ammer, an important recreation area of Greater Munich, is collected in a separate system; the ESPE GmbH company discharges its domestic and industrial wastewater into this municipal wastewater system. The wastewater from this dental/pharmaceutical company contains certain compounds which require pretreatment prior to discharge into the municipal wastewater system so as to avoid creating problems. Pretreatment of the following categories of wastewater is carried out separately: (1) polymer-containing water, (2) process water (produced by production or laboratory processes); (3) pump water (can contain all liquids used in the course of production); (4) special wastewater (produced, for The wastewater in the catchment of Lake Ammer. water (can comain an inquist used in the course of production); (4) special wastewater (produced, for example, when manufactured batches are defective); and (5) sulfate-containing water. In order to treat the different streams from the wastewater treat the different streams from the wastewater settling tanks, buffer and neutralization tanks are provided. If necessary, anti-foam agents can be added. Before the pretreated wastewater is discharged into the municipal wastewater system, it is monitored as to its composition. The plant is constructed in such a way that it provides the best possible protection for the groundwater. (See also W89-02791) (Shidler-PTT)

MEMBRANE SEPARATION PROCESSES FOR INDUSTRIAL EFFLUENT TREATMENT, C3 International, Inc., St. Paul, MN. P. S. Cartwright.

No. Cartwright.

In: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 189-200, 13 fig.

Descriptors: *Wastewater treatment, *Industrial wastewater, *Membrane processes, *Membrane filters, Ultrafiltration, Reverse osmosis, Waste recovery, Design criteria, Metal-finishing wastes.

The membrane processes of cross-flow microfiltra-In emembrane processes of cross-flow microfiltra-tion, ultrafiltration, and reverse osmosis offer ex-cellent potential for continuous removal of indus-trial contaminants. This paper emphasizes the 'point-of-source' concept of recycling or recover-ing specific components for reuse through the ap-plication of membrane separation technologies. The fundamentals of these technologies are de-corbind including membrane sequences and devices The fundamentals of these technologies are de-scribed, including membrane polymers and device configurations. In addition, complete system-design considerations are presented. Applications of membrane separation to treatment of metal-finishing, printed-circuit, and semiconductor-man-ufacturing effluents are described. (See also W89-02791) (Author's abstract)

ALTERNATIVE TREATMENT OF DE-ICING FLUIDS FROM AIRPORTS, Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).

M. Bouer. In: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 201-215, 8 fig, 8 tab, 2 ref.

Descriptors: *Wastewater treatment. *Pretreat-Descriptors: "wastewater treatment, "Pretreat-ment of water, "Airport wastes, "Alcohols, De-icing fluids, Ureas, Waste recovery, Waste storage, Aeration, Biological treatment, Nitrification, Design criteria, Construction costs, Switzerland.

In most cases low-molecular-weight alcohols are used for deicing airplanes, whereas for runways alcoholic compounds are often combined with urea as a non-corrosive deicer. At the Zuerich airport, different ways of treating the deicing fluids were studied during the winter periods of 1985-86 and studied during the winter periods of 1953-56 and 1986-87. Two technical solutions were considered, namely (1) central deicing stations for the airplanes and recycling of the concentrated deicing fluids after treatment, for instance, by ultrafiltration, and (2) aerobic or anaerobic treatment of the runoff

water and biological hydrolysis and oxidation of the urea. Several alternatives of centralized deicing stations were considered. However, lack of space and high investment costs did not favor this solu-tion. Furthermore, the runoff water from the runtion. Furthermore, the runoff water from the run-ways would have to be treated separately, causing investment costs similar to those with decentral-ized deicing. Therefore, only biological processes were considered as a feasible alternative for treat-ing the combined deicer runoff. The evaluation of the advantages and disadvantages of the investigat-ed treatment schemes and a cost analysis led to the conclusion that long-term aerated storage facilities, preferably at different locations at the airport, and preferably at different locations at the airport, and subsequent nitrification in a municipal treatment plant promise to be the most feasible solution for the removal of the deicer fluids. Storage in aerated tanks leads to full degradation of all deicer substances and to low dissolved organic carbon residuals after a storage period of 1.5 to 2 months. The water quality after the aforementioned storage period allows direct discharge to a municipal plant for nitrification. (See also W89-02791) (Shidler-PTT)

SEPARATORS AND EMULSION SEPARA-TION SYSTEMS FOR PETROLEUM, OIL, AND LUBRICANTS, Buderus A.G., Wetzlar (Germany, F.R.).

H. Noh.

H. Non. 1N: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 217-225, 14 fig.

Descriptors: *Wastewater treatment, *Oil wastes, *Separation techniques, *Emulsions, *Oil, *Petro-leum products, Lubricants, Toxicity, Hazardous materials, Density, Turbulence, Gravity flow, Ad-sorption, Design criteria, Emulsifiers, Service sta-tions, Maintenance facilities, Bilge.

A concentration of 1 g of oil/1 of water is generally toxic to fish, and 5% of this concentration is classified as hazardous. An important instrument for protecting water is the POL (petroleum/oil/lubricant) separator. The basic principle of POL separation is the use of the uplift forces in the gravitational field to separate liquids with different density. The problem is how to retain all of the POL particles in the effluent in the separator. The inlets to gravity separators must be properly designed to avoid forcing the incoming oil downward and to avoid turbulence that breaks up larger oil droplets into smaller ones. Minute droplets may then be transported to the outlet together with the oil droplets into smaller ones. Minute droplets may then be transported to the outlet together with the water flow. Frequently, very low concentrations of residual oil can only be obtained through further treatment. Therefore, the physical processes of adsorption and coalescence are used in addition to gravity in adsorption/coalescence separators, and residual concentrations of less than 5 mg/l of water can result. A prerequisite is a water/oil mixture without wetting agents, or wash-active substances. Effluents containing substances that impair POL separation or act as emulsifiers cannot be treated in gravity separators. These kinds of effluents have to gravity separators. These kinds of effluents have to undergo special treatment, for instance in emulsion-treatment systems. A system were the hydro-carbon content does not exceed 5 mg/l of water, to be used in connection with separators or by itself, was developed specifically for car washes, service stations that perform partial cleaning and remove protective coatings, and also for machine shops, railroad and aircraft maintenance facilities, and maritime operators who have to dispose of bilge water. (See also W89-02791) (Shidler-PTT) W89-02808

CHEMICAL TREATMENT OF FLUE GAS WASHING LIQUIDS, Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene. A. N. Grohmann, L. Bauch, and H.-P. Scheerer. In: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 227-236, 4 fig. 4 tab, 13 ref.

Descriptors: *Wastewater treatment, *Chemical treatment, *Incineration, Flue-gas washing liquids, Heavy metals, Desulfurization, Water pollution prevention, Sludge disposal.

When the flue gases of refuse incineration are wet-purified, pollutants from the refuse are transferred from the air into the water. The heavy metals can be removed from the water completely (up to 0.001 mg/l) through a combined carbonate/sulfide precipitation process, even though the pH value of 9 is not exceeded so that precipitation of magnesi-um is avoided. The ripse water from the flue-sas um is avoided. The rinse water from the flue-gas desulfurization process can be treated in the same desulfurization process can be treated in the same way. This allows a significant improvement of the environment with respect to heavy metals. Large quantities of mercury (up to 500 t/yr), lead (1000 t/yr), zinc (2000 t/yr), cadmium (60 t/yr), and copper (100 t/yr) accumulate particularly during refuse incineration, and using this method they can be concentrated in precipitated sludge, dewatered, and disposed of or recycled. (See also W89-02791) (Author's abstract) W89-02809

HYDROGEN SULPHIDE CONTROL IN MU-NICIPAL SEWERS,

Aalborg Universitetscenter (Denmark). Environmental Engineering Lab.

T. Hvitved-Jacobsen, B. Juette, P. H. Nielsen, and

N. A. Jensen.

In: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 239-247, 7 fig, 1 tab, 10 ref.

Descriptors: *Pretreatment of water, *Wastewater treatment, *Municipal wastewater, *Sewers, *Sewer gas, *Hydrogen sulfide, Anaerobic conditions, Sulfates, Organic matter, Temperature, Model studies, Chemical precipitation.

Increased concern for the impact of hydrogen sulfide produced under anaerobic conditions in wastewater has led to the need for pretreatment of the sewage. Intensive field investigations on hydrogen sulfide formation, impacts and control in servage systems were carried out during the period 1985-1987. Emphasis was given to determining the importance of sulfate, organic matter, temperature, and anaerobic residence time on sulfide formation and anaerobic residence time on sulfide formation in a 39-km pressure main. Based on these studies an empirical model for the sulfide buildup in sewers was proposed and evaluated. Variation of the diurnal sewage composition and flow and the importance of the type of sewage (municipal vs industrial) on sulfide formation was also taken into account. Furthermore, full-scale experiments in which iron sulfate was added to the sewage were account. Furthermore, full-scale experiments in which iron sulfate was added to the sewage were carried out under fluctuating conditions in order to optimize precipitation of the sulfide produced and reduce the impact of the hydrogen sulfide. A system for control and adjustment of the chemicals dosed was developed based on the proposed model and an evaluation of the importance of the external parameters and conditions. (See also W89-02791) (Author's abstract) Author's abstract) 89-02810

COAGULATION AS THE FIRST STEP IN WASTEWATER TREATMENT,

Norges Tekniske Hoegskole, Trondheim. H. Odegarrd.

In: Oregand.

In: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 249-260, 6 fig, 5 tab, 24 ref.

Descriptors: *Pretreatment of water, *Wastewater treatment, *Chemical treatment, *Coagulation, Municipal wastewater, Particle size, Norway.

Contamination in municipal wastewater is charac-terized in terms of particle size, and the fate of particles in biological treatment is discussed. Based on this, it is concluded that coagulation can be used as the first step in wastewater treatment. To demonstrate what is achievable by coagulation of raw wastewater, treatment results from over 100 raw wastewater, treatment results from over 100 Norwegian chemical treatment plants are presented. The following conclusions were drawn: direct particle separation is an effective way of lowering raw water contaminant levels; particles have a negative effect on the biochemical oxidation rate both in activated sludge and in biofilm processes, and should therefore be removed prior to biological treatment to reduce the organic load but also to

Waste Treatment Processes—Group 5D

promote rapid biodegradation; chemical treatment (coagulation followed by floc separation) removes most of the particles in raw wastewater and is consequently probably the most cost effective process that can be used as the first treatment step; and the results from Norwegian chemical treatand the results from Norwegian chemical treat-ment plants show that a very considerable reduc-tion of contaminants and a very stable effluent quality is obtained by coagulation of raw wastewater. (See also W89-02791) (Shidler-PTT) W89-02811

PRE-PRECIPITATION FOR IMPROVEMENT OF NITROGEN REMOVAL IN BIOLOGICAL WASTEWATER TREATMENT,

en Kemi A.B., Stockholm (Sweden). I. Karlsson

In: Arisson.

In

Descriptors: *Wastewater treatment, *Biological wastewater treatment, *Nitrogen removal, *Chemical precipitation, *Water pollution prevention, Eutrophication, Wastewater facilities, Nitrification, Denitrification, Pilot plants, Sludge, Economical Pilot
Chemically-coagulated sewage water produces an effluent low in both suspended matter and organics but, because of very serious problems with algal blooms and anaerobic bottom conditions in the blooms and anaerobic bottom conditions in the coastal waters of northern Europe, the discharge of nitrogen must be reduced. For existing sewage plants this is a problem because most of them have nsufficient biological volumes and retention times to achieve nitrification and denitrification in existing facilities. A fixed-film biosystem can be the natural choice for treating this water. Adapted to an existing sewage plant this volume-saving process allows nitrogen removal without tank expansion. Pilot-plant and full-scale results are discussed. The precipitated sludge contains 75% of the organic matter and represents a valuable internal carbon source. Some economic aspects concerning conventional biological treatment and the pre-precipitation process are also examined. (See also W89-02791) (Author's abstract) W89-02812

CHEMICALLY SUPPORTED OIL AND GREASE REMOVAL IN MUNICIPAL WASTEWATER TREATMENT PLANTS, Staedtisches Baureferat, Schweinfurt (Germany,

FR.)

F.R.).
H. Roggatz, and R. Klute.
IN: Pretreatment in Chemical Water and
Wastewater Treatment. Springer-Verlag, New
York. 1988. p 273-281, 8 fig., 4 ref.

Descriptors: *Pretreatment of water, *Wastewater Descriptors: "Pretreatment of water, "Wastewater treatment, "Chemical treatment, "Municipal wastewater, "Wastewater facilities, Oil wastes, Grease, Industrial wastes, Emulsions, Separation techniques, Sedimentation, Flotation, Iron com-

Jar tests were used initially to study the disruption of emulsions which are typical for the metal-proc-essing plants in the area of Schweinfurt, Germany. These tests were carried out with concentrated emulsions in order to demonstrate the possibilities for pretreatment in the Schweinfurt plants them-selves, as well as with samples diluted with municiseives, as well as with samples diluted with municipal wastewater. Increasing does of ferric salt were effective in breaking up emulsified grease and oil, thus making it possible to remove them. In addition, laboratory tests were carried out to investigate the influence of different types of phase separation on the removal efficiency. In the jar tests for ration on the removal efficiency. In the jar tests for emulsion disruption and separation of grease and oil, the separation of solid/liquid phases was carried out over a 30-minute sedimentation period. The application of dissolved air flotation or pressure flotation can be used as an alternative method for separating the phases. In the third part of the investigation experiments were attempted in which AVR (aluminum/iron sulfate) was dosed prior to the grease trap in the Schweinfurt treatment plant. Elimination could be improved from a mean value of 28% to a mean value of 74% through the use of

chemicals, whereas the variation in elimination due to the significant variation of the inflow concentrations ranged from 42% to 88%. (See also W89-02791) (Shidler-PTT) /89-02813

CHEMICAL-BIOLOGICAL TREATMENT VERSUS CHEMICAL TREATMENT: A CASE

STUDY, Nixdorf Computer Oy A.B., Vantaa (Finland).

A. Imavirus.

In: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 281-289, 15 fig, 1 tab.

Descriptors: *Wastewater treatment, *Chemical treatment, *Biological treatment, *Finland, Case studies, Coordination studies, Cost analysis, Cost-benefit analysis, Wastewater facilities, Design criteria, Floculation, Aeration, Sludge, Pumps, Chemical precipitation, Flow balancing, Bypass

In the 1980's the water authorities decided to change most of the chemical wastewater treatment plants in Finland to chemical/biological plants, but the cost/benefit ratio has often been poor. A case study was initiated at the Valkeakoski Treatment Plant; one of the pursues of the treatment plant one of the pursues of the charge of the pursues of the pursue of the pursues of the pursue study was initiated at the Valkeakoski Treatment Plant; one of the purposes of the study was to examine the possibilities of changing a chemical wastewater treatment plant to a chemical/biological plant by using only existing facilities. One half of the plant was changed to chemical/biological treatment by replacing flocculation devices with aeration pumps. Sludge-removing pumps from chemical treatment are now used as return sludge pumps. The decease of chemicals it has some for aeration pumps. Sludge-removing pumps from chemical treatment are now used as return sludge pumps. The dosage of chemicals is the same for chemical and biological/chemical treatment. The grid chambers were transformed into pre-precipitation basins by removing pre-aeration devices and all internal walls. An efficient flow-balancing unit was installed in the pre-precipitation basins; after flow balancing was implemented, effluent concentrations became acceptably low. The bypass facilities were also changed from underflow dams to overflow dams. After this change the quantity and pollutant concentrations of overflow water decreased drastically. This has not been a pilot-plant project but rather a full-scale project performed by permanent personnel. This means that all the practical difficulties are reflected in the results. The results are very promising. The probable savings as a result of efficient utilization of existing capacity are 15 to 20 million Finnish markkaa. This approach could be adopted in other chemical treatment plants; the nationwide savings would be significant. (See also W89-02791) (Shidler-PTT)

REUSE OF CHEMICAL SLUDGE FOR CONDITIONING OF BIOLOGICAL SLUDGES,
Miyazaki Univ. (Japan). Dept. of Civil Engineer-

ing.
Y. Watanabe, and A. Toyoshima.
IN: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 291-306, 27 fig, 2 tab, 5 ref.

Descriptors: *Chemical sludge, *Activated sludge, "Sludge conditioning, "Adsorption, "Orthophosphates, Flocculation, Settleable solids, Settling velocity, Sludge drying, Hydrogen ion concentralocity, Sludge drying, Hydrogen ion concentra-tion, Aluminum, Iron, Metal complexes.

The effects of chemical sludge, produced by co-agulation processes, on the settleability and dewa-terability of biological sludge, produced by the activated sludge processes are described. The set-tleability of the mixed biological and chemical sludges was significantly better than that of the unblended biological sludge. The average settling velocity and density of the discrete particles of the mixed sludges were much higher than those of the velocity and density of the discrete particles of the mixed sludges were much higher than those of the biological sludge. The improvement of the mixed sludges' settleability was influenced by both mixing and ALT ratios (ratios of aluminum ion concentration added to suspended particles concentration) of the chemical sludge. It was also determined that the dewaterability of the mixed sludges was improved and the specific resistance was lowered by one order of magnitude compared with the biologi-

cal sludge. Experimental results also are presented on the adsorption of orthophosphates on chemical sludge. The experimental investigation revealed that the amount of orthophosphates adsorbed per unit mass of chemical sludge was a function of pH and the amount of aluminum or iron contained in the chemical sludge. The maximum number of moles of orthophosphates adsorbed per mole of Al or Fe contained in the chemical sludge was about 0.2. The surface-coordination reaction between the or Pe contained in the chemical studge was about 0.2. The surface-coordination reaction between the orthophosphates and the hydroxo-Al or Fe complexes attached to the chemical sludge was verified by acid/base titration. (See also W89-02791) (Author's abstract) W89-02815

INFLUENCE OF SLUDGE FROM CHEMICAL BIOLOGICAL WASTEWATER TREATMENT ON NITRIFICATION AND DIGESTION,

Hanover Univ. (Germany, F.R.). Inst. fuer Sied-lungswasserwirtschaft und Abfalltechnik. C. F. Seyfried, H.-D. Kruse, and F. Schmitt.

IN: Pretreatment in Chemical Water Wastewater Treatment. Springer-Verlag, York. 1988. p 307-317, 6 fig, 1 tab. 19 ref.

Descriptors: *Wastewater treatment, *Sludge, Descriptors: "Wastewater treatment, "Studge, "Chemical treatment, "Biological wastewater treatment, "Nitrification, "Digestion, "Phosphorus removal, Denitrification, Chemical precipitation, Municipal wastewater, Anaerobic digestion, Iron,

The chemical precipitation of phosphates in municipal wastewaters is a process proven worldwide; biological phosphorus elimination is also being employed more and more so that results from practical experience with large plants are available. However, the effects of P elimination on nitrifica-tion and denitrification are often overlooked. The tion and denitrification are often overlooked. The effects of P precipitation on sludge age, acid capacity, and the 'activity' of the nitrifying bacteria are presented here. Biological P elimination supported by simultaneous precipitation seems to be the most appropriate solution when nitrification and denitrication are both necessary at the same time. The sludges from P precipitation and biological P elimination have the following properties: (1) An additional phosphate re-dissolution due to the use of chemical precipitation is not observed at normal dosages; however, in anaerobic treatment plants a chemical precipitation is not observed at normal dosages; however, in anaerobic treatment plants a phosphate re-dissolution of more than 60% is to be expected out of the sludge from biological P elimination. (2) An inhibition of the anaerobic digestion process, together with a lowered gas yield, is not found at normal dosages of precipitant; inhibition begins only at Fe concentrations greater than 10% of the solid content of the supplied mixed sludge. (3) The use of a precipitant containing sulfate for more than a couple of months did not affect the anaerobic digestion process in tests on a laboratory scale; this result was confirmed in practice. However, the sulfur content of the digester gas may increase slightly. (4) The digestion process with the addition of sludges from the precipitation is as stable as the anaerobic digestion with municipal sludge alone. (See also W89-02791) (Shidler-PTT) W89-02816

PRETREATMENT OF SLUDGE LIQUORS IN SEWAGE TREATMENT PLANTS, Aquateam-Norwegian Water Technology Centre

B. Paulsrud, B. Rusten, and R. Storhaug.

IN: Pretreatment in Chemical Water and
Wastewater Treatment. Springer-Verlag, New
York. 1988. p 319-326, 2 fig. 4 tab. 20 ref.

Descriptors: *Wastewater treatment, *Pretreatment of water, *Liquid sludge, *Wastewater facilities, Literature review, Septic wastewater, Activated sludge process, Norway.

Recycling of liquors from sludge-processing facili-ties can sometimes create serious problems in sewage-treatment plants. A literature review shows that separate treatment of sludge liquors is feasible and can be a solution to the problems that occur. In Norway several primary-chemical sewage-treatment plants are receiving septage

Group 5D—Waste Treatment Processes

(septic tank pumpings) in their sludge-handling systems; this practice increases the sludge-liquor flows and reduces their quality, thus creating an adverse impact on the coagulation/floculation process when recycling the liquor to the plant inlet. Treatment of such liquors by both the activated-sludge process and rotating biological contactors were tested, and these processes can produce an effluent quality which causes no harm when returned to the plant inlet. (See also W89-02791) (Author's abstract)

HEAVY METAL REMOVAL FROM SEWAGE SLUDGE: PRACTICAL EXPERIENCES WITH ACID TREATMENT, Technische Univ. Muenchen, Garching (Germany, F.R.). Lehrstuhl fuer Wasserguetewirtschaft. M. Ried.

Wastewater Treatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 327-334, 7 fig, 2 tab, 12 ref.

Descriptors: *Wastewater treatment, *Acid treatment, *Sludge, *Heavy metals, Fertilization, Hydrochloric acid, Sludge solids, Sludge cake, Costs,

Sewage sludge often contains heavy metals, reducing its value as a soil conditioner or fertilizer. Adding hydrochloric acid to anaerobically-digested sewage sludge causes at least 50 to 95% of the heavy metals to be dissolved; then, sludge liquids can be separated by means of filter presses and the addition of a combination of ferric salts and lime for conditioning. After dewatering, the sludge cake has a solids content of 35 to 50%. Sludge cake in which heavy metals have been thus reduced can be reused on agricultural soil after neutralization. The process is rather expensive, but the amount of refuse to be disposed of is reduced to about 5%. (See also W89-02791) (Shidler-PTT) W89-02818

TREATMENT OF FILTER EFFLUENTS FROM DEWATERING OF SLUDGES BY A NEW HIGH PERFORMANCE FLOCCULATION RE-ACTOR.

ACTOR,
Technische Univ. Berlin (Germany, F.R.). Inst. fuer Chemieingenieurtechnik.
U. Wiesmann, K. Oldenstein, and L. Fechter.
IN: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 335-345, 11 fig, 5 ref.

Descriptors: *Wastewater treatment, *Sludge drying, *Flocculation, *Wastewater facilities, *Lake restoration, *Water quality control, Recreation, Filtrate, Phosphorus removal, Clarification, Germany, Performance evaluation.

The Schlachtensee, the Krummen Lanke, Grunewaldsee, and Hundekehlensee, form the Grunewald lake district. Because of the great im-portance of this lake district as a recreation area for the inhabitants of West Berlin, the water for the inhabitants of West Berlin, the water pumped into the Schlachtensee has been treated by precipitation, flocculation, sedimentation, and filtration since 1980 in order to remove phosphorus; this procedure has also had a favorable effect on the water quality of the Grunewaldsee. Using a dealudging process as a second part of the regeneration program of the Grunewald lake district, a eration program of the Grunewald lake district, a sludge layer of 1.5 m is to be removed in order to enlarge the water space of the Grunewaldsee, which has a maximal depth of only 3 m. With current techniques, the formation of macroflocs requires between 10 and 60 minutes. Because only requires between 10 and 60 minutes. Because only a small area of 30 square m was available for the treatment of a filter effluent from dewatering of sludges produced by desludging the lake, a process with high efficiency was required for the removal of phosphorus and turbidity from the filtrate. Therefore a cylindrical stirred tank was used that was characterized by the same narrow distribution of local velocity gradients and residence times as a new flocculation reactor. In order to achieve the water quality required for discharge into the lake, a total mean residence time of only 14 minutes is sufficient (0.5 min for precipitation and coagulation in a tube reactor, 2 min for flocculation in the

cylindrical stirred reactor and 11.5 min in a lamellar separator). The filter effluent of about 60 cubic m/h has been treated for nearly two years without any trouble. (See also W89-02791) (Shidler-PTT) W89-02819

PRETREATMENT FOR WASTEWATER REC-LAMATION AND REUSE.

California State Water Resources Control Board. Sacramento.

Sacramento.
T. Asano, and R. Mujeriego.
IN: Pretreatment in Chemical Water and
Wastewater Treatment. Springer-Verlag, New
York. 1988. p 347-356, 2 tab, 16 ref.

Descriptors: *Wastewater treatment, *Pretreatment of water, *Wastewater renovation *Water reuse, *Viruses, Wastewater irrigation, Groundwater recharge, Tertiary wastewater treatment, Advanced wastewater treatment, Population exposure, Coagulation, Filtration, Chlorination.

The recent trend toward the use of reclaimed municipal wastewater for purposes such as land-scape and food-crop irrigation, groundwater re-charge, and recreational impoundment often recharge, and recreational impoundment often re-quires tertiary or advanced wastewater treatment. These water-reuse applications result in exposing the public to reclaimed wastewater; thus assurance of microbiological and, particularly, virological safety is of utnost importance. Because of uncer-tainties associated with risk assessment of viruses in reclaimed reclaimed wastewater, improvements in wastewater-treatment technology and operation of wastewater-treatment technology and operation of both conventional and tertiary wastewater-treat-ment plants are warranted. By optimizing wastewater treatment and coagulation/filtration processes coupled with effective chlorination, it is reasonable to expect that essentially virus-free re-claimed water can be produced in a cost-effective manner. The preferred methods of achieving essen-tially virus-free reclaimed wastewater are (1) to tially virus-free reclaimed wastewater are (1) to tially virus-free reclaimed wastewater are (1) to focus more attention on improving the quality of secondary effluent and operational reliability and (2) to optimize chemical coagulation/flocculation in direct filtration systems. Both of these measures in direct filtration systems. Both of these measures would allow for the use of lower chlorine dosages in disinfection without jeopardizing virus removal and/or inactivation efficiency. (See also W89-02791) (Shidler-PTT) W89-02820

WASTE MINIMIZATION AUDIT REPORT: CASE STUDIES OF MINIMIZATION OF MER-CURY-BEARING WASTES AT A MERCURY CELL CHLORALKALI PLANT, Versar, Inc., Springfield, VA. For primary bibliographic entry see Field 5E. W89-02821

ECONOMIC EVALUATION OF CARBON AD-SORPTION/ION EXCHANGE WASTEWATER TREATMENT OPTIONS FOR SUNFLOWER AAP NO WASTEWATER TREATMENT FACIL-

ITY, Little (Arthur D.), Inc., Cambridge, MA. A. A. Balasco, G. C. Cheng, E. L. Field, and V. R. Vejins.

Vejins. Available from the National Technical Information Service, Springfield, VA 22161, as AD-A189 358. Price codes: A04 in paper copy, A01 in microfiche. Final Report, July 1987. 65p, 10 fig. 14 tab, 4 ref, 2 append. DOD Contract DAAK11-85-D-0008.

Descriptors: *Wastewater treatment, *Adsorption, *Ion exchange, Carbon, Waste management, Costs, Evaporation, Separation, Economic aspects, Sunflower Army Ammunition Plant, Industrial wastes.

A preliminary engineering design study and cost evaluation was performed for a full-scale nitro-guanidine (NQ) wastewater treatment facility at Sunflower Army Ammunition Plant (AAP). The objective was to provide an estimate of the capital investment and operating costs for the wastewater treatment technology option involving activated carbon adsorption and ion exchange for primary separation, and multiple-effect evaporation and spray drying for volume reduction. During the course of this study, however, it became evident

that the process economics could be significantly improved if the ion exchange step was eliminated from the process scheme. The estimated capital investment required is \$6.6 million with ion exchange and \$4.6 million without (in 1986 dollars). The estimated operating costs are \$30 million/yr with ion exchange and \$7 million/yr without, mainly as a result of eliminating costly regenerated chemicals. (Lantz-PTT)

IT'S YOUR CHOICE: A GUIDEBOOK FOR LOCAL OFFICIALS ON SMALL COMMUNITY WASTEWATER MANAGEMENT OPTIONS.

Environmental Protection Agency, Washington, DC. Municipal Facilities Div.

DC. Municipal Facilities Div. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-163027. Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA 430/9-87-006, September 1987. 73p, 3 append.

Descriptors: *Municipal wastewater treatment, *Wastewater treatment, *Management planning, Public participation, Costs, Economic aspects, Fi-

The many options available to solve existing and future wastewater problems are considered. Infor-mation has been included on how to define the mation has been included on how to define the problem, how to get help from other sources and where to find it, how to choose a consulting engi-neer, making up a plan to deal with a particular situation, various approaches to wastewater man-agement, and how to pay for the wastewater system. The success or failure of these efforts system. The success or failure of these efforts depends on several important things which should be kept in mind throughout the entire planning process. These are: select the right consultants; involve the public; consider all the options; estimate the project cost; develop a plan for financing the project; and determine how the system will be managed after its construction. (Lantz-PTT) W89-02838

WASTE MINIMIZATION AUDIT REPORT: CASE STUDIES OF MINIMIZATION OF SOL-VENT WASTES AND ELECTROPLATING WASTES AT A DOD (DEPARTMENT OF DE-FENSE) INSTALLATION, Versar, Inc., Springfield, VA. M. Drabkin, and P. Sylvestri.

M. Drabkin, and P. Sylvestri. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-166780. Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA/600/2-88/010, February 1988. 73p, 9 fig, 16 tab, 20 ref.

Descriptors: *Wastewater treatment, *Solvents, *Case studies, *Metal-finishing wastes, *Management planning, Waste management, Sludge, Mercury, Oil wastes, Industrial wastes, Economic aspects, Cadmium, Cyanide.

pects, Cadmium, Cyanide.

The U.S. EPA is encouraging hazardous waste generators to develop programs to reduce the generation of hazardous waste. To foster such programs, the Agency's Office of Research and Development Hazardous Waste Engineering Research Laboratory (ORD/HWERL) is supporting the development and evaluation of a model hazardous waste minimization audit (WMA) procedure using the EPA hierarchy of waste minimization (WM) options, with source reduction being more desirable and recycle/reuse less desirable. Treatment options, although not considered WM, were evaluated if neither of the former alternatives was available. The WMA were conducted at generators of a number of generic hazardous wastes, including corrosives, heavy metals, spent solvents, and cyanides. In 1987, the HWERL WMA program concentrated on ORD's top priority RCRA K and F waste list. Audits were conducted at generators of KO71 and K106 wastes (mercury cell chloralkali plants), K048-K052 wastes (sludges and solids from petroleum refining), F002-F004 wastes (spent solvents), and F006 wastes (wastewater treatment sludges from electroplating operations). A WMA carried out at a DOD installation responsible for the rehabilitation of worn Army tanks was sible for the rehabilitation of worn Army tanks was

Waste Treatment Processes—Group 5D

aimed at developing WM options for F002, F004, and F006 listed wastes. Two source reduction options were developed by the audit team for F002 and F004 wastes with attractive payback periods and substantial potential savings in waste solvent disposal costs. A number of source reduction and disposal costs. A number of source reduction and recycle/reuse options were developed for the electroplating wastes which, if successfully implemented, could result in substantial savings in F006 waste disposal costs as well as achieve compliance with the DOD installation's NPDES permit limitations for cadmium and cyanide. (Author's abstract) W89-12839

CORRECTIVE MEASURES FOR RELEASES TO GROUNDWATER FROM SOLID WASTE MANAGEMENT UNITS, GCA Corp., Bedford, MA. GCA Technology

For primary bibliographic entry see Field 5G. W89-02844

HANDBOOK: IMPROVING POTW PERFORMANCE USING THE COMPOSITE CORRECTION PROGRAM APPROACH,
Process Applications, Inc., Fort Collins, CO.
B. A. Hegg, J. R. Schultz, and K. L. Rakness.
Available from the National Technical Information
Service, Springfield, VA. 22161, as PB88-184007.
Price codes: A10 in paper copy, A01 in microfiche.
Report No. EPA/625/684-008, October 1984.
258p, 13 fig, 27 tab, 62 ref, 15 append.

Descriptors: *Wastewater treatment, *Biological treatment, *Performance evaluation, Activated sludge, Aeration, Sludge stabilization, Biofiltration.

The Handbook provides information on methods to economically improve the performance of existing publicly owned treatment works (POTWs). It is 'how-to' oriented and describes an approach that POTW owners can use to achieve improvements in treatment without major capital expenditures. The evaluation phase is a thorough review and analysis of a POTW's design capabilities and associated administration, operation, and maintenance practices. It is conducted to provide information for POTW administrators to make decisions regarding efforts necessary to improve performance. The primary objective is to determine if significant improvements in treatment can be achieved withgarding efforts necessary to improve performance. The primary objective is to determine if significant improvements in treatment can be achieved without making major capital expenditures. The performance improvement phase is a systematic approach to eliminating those factors that limit performance in existing POTWs. Its major benefit is that it optimizes the capability of existing facilities to perform better and/or treat more wastewater. Focus is on POTWs treating typical municipal wastewater compatible with common biological wastewater treatment processes; specifically on mechanical plants using activated sludge (suspended growth), trickling filters (fixed film), and variations of these processes for secondary treatment. Variations of suspended growth processes included are: plug flow, complete mix, extended aeration, contact stabilization, tapered aeration, oxidation ditches, and step feed. Fixed film processes included are: conventional rock filters, plastic media filters, redwood media filters, activated biofilters (ABFs), and rotating biological contactors (RBCs). (Lantz-PTT)

COMPOSTING OF MUNICIPAL WASTEWATER SLUDGES. Environmental Protection Agency, Cincinnati, OH. Center for Environmental Research Informa-

tion.
Available from the National Technical Information Service, Springfield, VA. 22161, as PB88-186119. Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA/82/4-85/014, August 1985. 68p, 82 fig, 24 tab, 21 ref.

Descriptors: *Sludge utilization, *Wastewater treatment, *Municipal wastewater, *Composting, *Sludge, Monitoring, Economic aspects, Regulations, Case studies, Standards.

Sludge management is a major problem for many municipalities. Ever increasing quantities of sludge

are being generated as municipalities begin to comply with the wastewater treatment require-ments of the Clean Water Act and as advances are comply with the wastewater treatment requirements of the Clean Water Act and as advances are made in wastewater treatment. Composting is a natural microbiological process that degrades sludge to a stable humus-like material that can be recycled to the land for use as a soil conditioner and low-grade fertilizer. Composting can have advantages over other sludge management alternatives, including lower energy requirements and capital investment than incineration; a more manageable product than land application; and a more productive, beneficial use of sludge than landfilling or ocean disposal. Because composting prepares sludge for use as a resource rather than as a waste and because it conserves energy, it qualifies as an alternative technology under the Federal Construction Grants Program. This seminar publication provides practical information on current methods of composting municipal wastewater sludges. It is intended for government and private sector individuals involved in the planning, design, and operation of municipal sludge treatment and disposal systems. Chapters present: general principles of the composting process and system design, including windrow, static pile, and in-vessel systems; public relations; aesthetic considerations; marketing and distribution of compost; economics; design and site layout considerations; monitoring; equipment selection; and public health considerations. (Lantz-PTT) W89-02855

ASSIMILATIVE CAPABILITIES OF RETENTION PONDS,

Geological Survey, Tallahassee, FL. E. H. Martin, and J. L. Smoot.

E. H. Martin, and J. L. Smoot. Available from the National Technical Information Service, Springfield, VA. 22161, as PB88-180153. Price codes: A04 in paper copy, A01 in microfiche. Report No. FHWA/DOT/BMR-303-86, April 1986. 75p, 19 fig, 10 tab, 17 ref.

Descriptors: *Lagoons, *Wastewater treatment, *Settling basins, *Wetlands, *Urban runoff, Pollutant load, Nitrates, Orthophosphates, Suspended solids, Lead, Zinc, Nitrogen, Phosphorus, Heavy metals, Fate of pollutants.

The efficiency of a detention pond and wetlands temporary storage system to reduce constituents loads in urban runoff was determined. The reduction efficiencies for 22 constituents, including the dissolved, suspended and total phases of many of the constituents were investigated. A new method not previously discussed in technical literature was developed to determine the efficiency of a temporary storage system unit such as a detention pond developed to determine the efficiency of a tempo-rary storage system unit such as a detention pond or wetlands. The method provides an efficiency, called the regression efficiency, determined by a regression made of loads-in against loads-out of a unit with the intercept of the regression con-strained to zero. The regression efficiency of the treatment unit is defined as unity minus the regres-sion slope. The system (pond and wetlands) achieved appreciable reductions of loads for most constituents. Significant positive regression effiachieved appreciable reductions of loads for most constituents. Significant positive regression efficiencies for the system were found for all constituents except the nutrients dissolved nitrate and dissolved orthophosphate. Systems regression efficiencies were 55% for total solids, 83% for total lead, 70% for total airc, 36% for total nitrogen, and 43% for total phosphorus. (Author's abstract) W89-02856

SELECTION GUIDE FOR VOLATILIZATION TECHNOLOGIES FOR WATER TREATMENT,

IT Corp., Knoxville, TN. For primary bibliographic entry see Field 5F. W89-02863

VALUE ENGINEERING FOR SMALL COM-MUNITIES,

Environmental Protection Agency, Washingto DC. Office of the Assistant Administrator f

For primary bibliographic entry see Field 6B. W89-02865

MUNICIPAL WASTEWATER SLUDGE COMBUSTION TECHNOLOGY.

Environmental Protection Agency, Cincinnati, OH. Center for Environmental Research Informa-

tion.

Available from the National Technical Information Service, Springfield, VA. 22161, as PB88-186101. Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA/625/4-85/015, September 1985. 177p, 37 fig, 37 tab.

Descriptors: *Municipal wastewater, *Incineration, *Wastewater treatment, *Sludge, *Combustion, Costs, Sludge drying, Air pollution, Ash, Waste disposal, Landfills.

Various municipal sludge combustion systems are described and evaluated. The necessity for consid-ering and evaluating the costs involved in the total described and evaluated. The necessity for consul-ering and evaluating the costs involved in the total sludge management train, including dewatering, combustion, air pollution control, and ash disposal processes are also emphasized. The report is in-tended to supplement, but not replace, EPA tech-nology transfer publications on sludge treatment and disposal, dewatering municipal wastewater sludges, municipal sludge landfills, and land appli-cation of municipal sludge andfills, and land appli-cation of municipal sludge and so the superior of the means of processing sludge solids for ultimate dis-posal and presents factual answers supported by case histories. The primary objectives of this docu-ment are: (1) to assess the current status of munici-pal sludge combustion technology as to perform-ance of in-place systems, environmental concerns, and regulatory agency viewpoints; (2) to determine what needs to be done to make municipal sludge combustion more economical, including upgrading the performance of present and future systems; and (3) to discuss technology in the R&D stage. (Authe performance of present and future systems; and (3) to discuss technology in the R&D stage. (Author's abstract) W89-02872

BIOTREATMENT SYSTEMS: VOLUME I. CRC Press, Boca Raton, Florida. 1988. Vol. 1, 328p. Edited by Donald L. Wise.

Descriptors: *Anaerobic digestion, *Aerobic treatment, *Water treatment, *Biological treatment, *Wastewater treatment, *Biological wastewater treatment, Bacteria, Industrial wastewater, Hazardous materials, Phenols, Organic compounds.

Biotreatment Systems has as its major theme the biotreatment of organic residues. This theme primarily encompasses the field of anaerobic methane fermentation, with an emphasis on treatment of complex wastes. The text is intended to present a complex wastes. The text is intended to present a comprehensive overview of the most practical research programs that are being carried out in this emerging field of international significance. Volume I includes the following chapters: Aerobic Treatment of Sewage from Lignite (Brown Coal) Processing: Literature Study on the Feasibility of Microbiological Decontamination of Polluted Soils; Treatment of Hazardous Wastes in a Sequencing Batch Reactor; Anaerobic Degradation of Phenolic Compounds with Applications to Treatment of Industrial Wastes; Biological Treatment of Toxic Industrial Wastes; Biological Treatment of Toxic Industrial Wastes; and Microbial, Chemical, and Technological Aspects of the Anaerobic Digestion of Organic Pollutants. (See W89-02915 thru W89-02921 and W89-02927) W89-02914 W89-02914

AEROBIC TREATMENT OF SEWAGE FROM LIGNITE (BROWN COAL) PROCESSING, Institut fuer Biotechnologie, Leipzig (German

M. Ringpfeil, U. Stottmeister, U. Behrens, G. Martius, and G. Burger.
IN: Biotreatment Systems. Vol. 1. CRC Press, Boca Raton, Florida. 1988. p 1-61, 21 fig. 28 tab, 139 ref.

Descriptors: *Water pollution prevention, *Wastewater treatment, *Biological wastewater treatment, *Coal, *Industrial wastewater, Lignite, Sludge, Sludge disposal, Bac-

Group 5D—Waste Treatment Processes

Experiences gained from decades of operation of biological purification plants in the brown coal industry have led to industrial plants taking into account the latest knowledge of biotechnology. The formation and refinement of brown coal, the physical, chemical, and biological methods of puri-fying brown coal processing waste waters, and the possibilities for the utilization and disposal of the possibilities for the utilization and disposal of the resulting sludge are reviewed, with an emphasis on the biological purification of brown coal industry wastewaters by technical plants in East Germany. Amounts of wastewater may be reduced by new technologies such as coal liquefaction, but the development of new brown coal resources, such as velopment of new brown coal resources, such as saliferous coal, raises new wastewater treatment problems. The use of commercially adopted strains of microorganisms appears to offer few advantages. The construction of new strains by plasmid transfer may offer decisive advantages for the degradation of synthetically produced, persistent substances in wastewater. (See also W89-02914) W89-02915

TREATMENT OF HAZARDOUS WASTES IN A SEQUENCING BATCH REACTOR, CECOS International, Inc., Buffalo, NY. P. A. Herzbrun, R. L. Irvine, K. C. Malinowski,

P. A. Herzbrun, R. L. Irvine, R. C. Mainowski, and M. J. Hanchak. IN: Biotreatment Systems. Vol. 1. CRC Press, Boca Raton, Florida. 1988. p 157-167, 6 fig, 8 tab, 4 ref. NYSERDA Contract 601-CON-IC-84.

Descriptors: *Water pollution, *Wastewater treatment, *Biological wastewater treatment, *Hazardous materials, *Organic compounds, *Phenols, *Activated carbon, Cost analysis, Activated sludge, Organic carbon, Sequencing batch reactor.

The primary means for removing organic compounds at the Chemical and Environmental Conservation Systems (CECOS) International Niagara Falls Wastewater Treatment Plant (NFWTP) is activated carbon. Because of the cost and energy demands associated with the use of activated carbon, CECOS investigated the sequencing batch reactor (SBR), a biological treatment system, as an alternate method for the removal of organic carbon from wastewater. Bench-scale studies were initiated by CECOS in August 1983. The bench-scale reactors were operated at several loadings scale reactors were operated at several loadings initiated by CECOS in August 1983. The bench-scale reactors were operated at several loadings and four detention times. A description of the CECOS hazardous waste disposal site is presented along with SBR bench-scale results on organic carbon and phenol removal, sludge-setting charac-teristics, and oxygen uptake rates. Based on the results, a full-scale SBR system was designed, with construction beginning in December 1983. The full-scale SBR was placed into operation in June 1984. The role of activated carbon will be shifted full-scale SBR was placed into operation in June 1984. The role of activated carbon will be shifted from that of being the rimary means for removing organic carbon to a more cost-effective role which involves final polishing of the effluent. A 1- or 2-day power failure should have no short- or long-term effect on system performance. (See also W89-02914) (Sand-PTT)

W89-02917

ANAEROBIC DEGRADATION OF PHENOLIC COMPOUNDS WITH APPLICATIONS TO TREATMENT OF INDUSTRIAL WASTE

WATERS,
Alberta Univ., Edmonton. Dept. of Microbiology.
P. M. Fedorak, and S. E. Hrudey.
IN: Biotreatment Systems. Vol. 1. CRC Press,
Boca Raton, Florida. 1988. p 169-225, 8 fig, 14 tab,

Descriptors: *Wastewater treatment, *Biological wastewater treatment, *Biodegradation, *Anaero-bic digestion, *Industrial wastewater, *Phenols, Bacteria, Organic carbon, Methane bacteria

The mechanisms of anaerobic biodegradation of phenolic compounds are reviewed with particular emphasis on the fermentation processes which ultimately yield methane. These microbial activities and capabilities are considered in light of the use in the treatment of phenolic waste waters. The sucthe treatment of phenolic waste waters. The sus-ceptibilities of a large number of phenolics to be degraded under anaerobic conditions are sumr

rized and the phenolic composition of various wastewaters is surveyed. Only laboratory-scale studies on the anaerobic treatment of actual and studies on the anaerootic treatment of actual and synthetic phenolic wastewaters have been report-ed; these studies are also reviewed. While methan-ogenic fermentation is not capable of degrading all phenolics found in industrial wastewater, the proc-ess may be developed to remove the majority of the organic carbon present as fermentable pheno-lics. Subsequent treatment would be required to remove the remaining phenolics. (See also W89-02914) (Sand-PTT) W89-02918

BIOLOGICAL TREATMENT OF TOXIC IN-DUSTRIAL WASTE, National Environmental Engineering Research Inst., Nagpur (India). Environmental Microbiology

P. Kumaran, and N. Shivaraman.

IN: Biotreatment Systems. Vol. 1. CRC Press,
Boca Raton, Florida. 1988. p 227-283, 9 fig, 12 tab,

Descriptors: *Toxic wastes, *Wastewater treatment, *Toxicity, *Detoxification, *Biodegradation, *Biological wastewater treatment, *Industrial wastewater, Pollutants, Phenols, Ammonia, Cyanide, Pesticides, Hydrocarbons, Heavy metals, Microbial degradation, Bacteria.

The causes for the deteriorating environmental The causes for the deteriorating environmental conditions resulting from the discharge of toxic industrial effluents are reviewed. The toxicity of the pollutants present in these wastes (phenolics, ammonia, cyanide, thiocyanates, hydrocarbons, pesticides and heavy metals) to aquatic and terrestrial life is evaluated. The ability of certain microorganisms to detoxify and sometimes utilize these pollutants as carbon and energy sources is discussed. The merits and demerits of the application of hiotechology to the treatment of toxic industriacussed. The merits and demerits of the application of biotechnology to the treatment of toxic industrial effluents through the 'classical approach' are covered, as are recent trends in bioengineering with special reference to biochemical augmentation of wastewater treatment plants. (See also W89-02914) (Sand-PTT) W89-02919

MICROBIAL, CHEMICAL, AND TECHNO-LOGICAL ASPECTS OF THE ANAEROBIC DEGRADATION OF ORGANIC POLLUTANTS, Agricultural Univ., Wageningen (Netherlands). Dept. of Water Pollution Control. I. W. Koster.

IN: Biotreatment Systems. Vol. 1. CRC Press, Boca Raton, Florida. 1988. p 285-316, 6 fig, 5 tab,

Descriptors: *Biodegradation, *Anaerobic digestion, *Methane bacteria, *Wastewater treatment, *Biological wastewater treatment, *Organic compounds, Fate of pollutants, Microbial degradation, Bacteria.

The microbiology, (bio)chemistry, and technology of the anaerobic degradation of organic pollutants is reviewed. The main environmental factors which are important for a stable anaerobic digestion include acidity and buffering capacity, temper-ature nutrients, and toxic (inhibitory) compounds ature nutrients, and toxic (inhibitory) compounds in the wastewater. Since the methanogenic bacteria are the key organisms in anaerobic digestion, the discussion of the environmental factors focuses on methanogenesis, but the impact of these factors on the other metabolic stages in the process of anaerobic digestion is also dealt with. For many industrial wastewaters, there is no need to optimize hydrolysis and acidogenesis, because the rates are sufficiently high even at suboptimal conditions. It is concluded that anearobic digestion is a form of biotechnology which has good potential in solving the problem of environmental pollution with organic wastes and wastewaters. (See also W89-02914) (Sand-PTT) wastewaters. W89-02920

BIOTREATMENT SYSTEMS: VOLUME II. CRC Press, Boca Raton, Florida. 1988. Vol. 2. 248p. Edited by Donald L. Wise. Descriptors: *Anaerobic digestion, *Biological treatment, *Wastewater treatment, *Biological wastewater treatment, Industrial wastewater, Phenols, Heavy metals, Sludge, Hazardous materi-

Biotreatment Systems has as its major theme the biotreatment of organic residues. This theme pri-marily encompasses the field of anaerobic methane fermentation, with an emphasis on treatment of fermentation, with an emphasis on treatment of complex wastes. The text is intended to present a comprehensive overview of the most practical research programs that are being carried out in this emerging field of international significance. Volume II includes the following chapters: Toxicity of Heavy Metals to Thermophilic Anaerobic Digestion; In Situ Biological Treatment of Hazardous Waste-Contaminated Soils; The Role of Phenolic and Humic Compounds in Anaerobic Digestion Processes; Bacterial Leaching of Heavy Metals from Anaerobically Digested Sludge; and Biodegradation of Recalcitrant Industrial Wastes. (See W89-02922 thru W89-02927 and W89-02914) (Sand-PTT) (Sand-PTT) W89-02921

TOXICITY OF HEAVY METALS TO THERMO-PHILIC ANAEROBIC DIGESTION,

Technical Univ. of Denmark, Lyngby. Inst. for Bioteknologi. B. K. Ahring, and P. Westermann

IN: Biotreatment Systems. Vol. 2. CRC Press, Boca Raton, Florida. 1988. p 1-21, 1 fig, 1 tab, 90 ref. Danish Natural Science Research Council Grants 11-3888 and 11-3982.

Descriptors: *Heavy metals, *Toxicity, *Anaero-bic digestion, *Wastewater treatment, Biological wastewater treatment, Municipal wastewater, In-dustrial wastewater, Bacteria, Copper, Cadmium, Chromium, Mercury, Nickel, Zinc.

Organic matter subject to anaerobic digestion is generally very heterogeneous and may contain compounds toxic to the anaerobic microorganisms in the digester. Heavy metals such as Cu, Cd, Cr, Hg, Ni and Zn are often present in combined municipal and industrial wastewater. The impact of heavy metals as environmental pollutants to anaerobic digestion is discussed. As thermophilic digestion is an expanding technology within the treatment of organic wastes, and as few investigations concerning heavy metal toxicity have been done in this area, the focus is on the thermophilic aspects of heavy metal toxicity. None of the experiments reviewed indicate that sensitivity or instability caused by heavy metals in the wastewater is higher under thermophilic conditions. (See also W89-02921) mesophilic conditions. (See also (Sand-PTT) W89-02921) W89-02922

IN SITU BIOLOGICAL TREATMENT OF HAZ-ARDOUS WASTE-CONTAMINATED SOILS, Utah State Univ., Logan. Dept. of Civil and Envi-ronmental Engineering. R. R. Dupont, R. C. Sims, J. L. Sims, and D. L.

IN: Biotreatment Systems. Vol. 2. CRC Press, Boca Raton, Florida. 1988. p 23-94, 4 fig, 20 tab, 167 ref, append.

Descriptors: *Soil contamination, *Biological treatment, *Cleanup, *Decontamination, *Biodegradation, *Detoxification, Waste management, Bacteria, Pollutants, Soil management, Microbial degradation, In situ treatment, Public health.

In situ treatment is the use of the upper soil/plant system for the biological and/or physical/chemical transformation, degradation, and detoxication of transformation, degradation, and detoxication of waste constituents. The control and management of biochemical processes and site/soil factors to accomplish the in situ biological treatment of hazardous waste contaminated soils involves two basic, fundamental soil/waste interaction processossic, initialimitation waste interaction processes, i.e. biological transformation and physical immobilization of waste constituents. These interaction processes, the waste/soil/site factors which affect them, and the means for the control and

Waste Treatment Processes—Group 5D

management to optimize in situ treatment at hazardous waste sites are reviewed. Topics covered include methodology, selection of treatment techiques, monitoring requirements, public health/risk assessment techniques, and the application of methodology to in situ management. Fundamental process influencing soil/waste interactions are described in an appendix. (See also W89-02921) (Sand-PTT) W89-02923

ROLE OF PHENOLIC AND HUMIC COM-POUNDS IN ANAEROBIC DIGESTION PROC-

POUNDS IN ANAEROBIC DIGESTION PROCESSES, Agricultural Univ., Wageningen (Netherlands). Dept. of Water Pollution Control. J. A. Field, and G. Lettinga. IN: Biotreatment Systems. Vol. 2. CRC Press, Boca Raton, Florida. 1988. p 95-123, 7 fig, 6 tab,

Descriptors: *Aerobic digestion, *Farm wastes, *Biodegradation, *Phenols, *Humic compounds, *Wastewater treatment, Biological wastewater treatment, Industrial wastewater, Bacteria.

Certain wastewaters generated from agricultural and petrochemical industries contain moderate to high concentrations of phenolics. Conditions prior to waste treatment may subject the phenols to transformations. The transformations can produce phenolic products which may influence the performance of anaerobic treatment by inhibiting the formance of anaerobic treatment by inhibiting the process or by being resistant to anaerobic degradation. The extent to which these transformations alter the role of phenolic compounds in anaerobic digestion is evaluated. Special consideration is given to transformations analogous to humus-forming processes since industrial process waters are often subject to either alkaline conditions or enzymes which catalyze phenol oxidation. (See also W89-02921) (Sand-PTT)

BACTERIAL LEACHING OF HEAVY METALS FROM ANAEROBICALLY DIGESTED SLUDGE

Esso Petroleum Canada, Sarnia (Ontario). Re-

Esso Petroleum Canada, Sarina (Ontario). Research Dept. L. T. K. Wong, and J. G. Henry. IN: Biotreatment Systems. Vol. 2. CRC Press, Boca Raton, Florida. 1988. p 125-169, 15 fig, 23

Descriptors: *Sludge digestion, *Sludge utilization, *Anaerobic digestion, *Heavy metals, *Leaching, *Bacteria, *Wastewater treatment, Chelation, Ion exchange, Chlorination.

The physical/chemical characteristics of digested ne pnysical/chemical characteristics of digested sludge and methods for the removal of heavy metals from sewage sludge are discussed. These processes include acidification, chemical chelation, liquid ion exchange, chlorination, and oxidative acid hydrolysis. However, factors such as high costs and operational difficulties have limited prac-tical amplications of these methods. acosts and operational difficulties have limited practical applications of these methods. A new approach to remove heavy metals from sewage sludge utilizes a biological oxidation process called bacterial leaching, which may be defined as the solubilization of metals from insoluble minerals directly by the products of metabolism. Research on bacterial leaching of anaerobically digested sludge has proceeded from batch to continuous system. Attempts have also been made to improve or modify the process downstream from bacterial leaching. If the feasibility of the process can further be demonstrated on a pilot scale, it may provide a practical solution to the sludge disposal/utilization problem. (See also W89-02921) (Author's abstract) W89-02925

BIODEGRADATION OF RECALCITRANT IN-DUSTRIAL WASTES.

National Environmental Engineering Research Inst., Nagpur (India). T. Chakrabarti, P. V. R. Subrahmanyam, and B. B.

IN: Biotreatment Systems. Vol. 2. CRC Press, Boca Raton, Florida. 1988. p 171-234, 8 fig. 6 tab,

Descriptors: *Wastewater treatment, *Biological wastewater treatment, *Industrial wastewater, *Activated carbon, *Ozonation, Advnced *Activated carbon, *Ozonation, Advnced wastewater treatment, Toxicity, Oxidation, Bacteria, Biodegradation, Anaerobic digestion, Genetic

The biological processes for biodegradable and recalcitrant wastewaters generated from different industries and anaerobic treatment of waste sludge generated during biological treatment processes are reviewed. In addition to the established techare reviewed. In addition to the established technology for biological treatment processes, newer approaches in waste process biotechnology are discussed, including powdered activated carbon and granular activated carbon or processes involving pretreatment of recalcitrant wastes by ozonation, hydrogen peroxide treatment, and photooxidation. Genetic engineering has shown increasing promise in preparing cultures which can be used successfully to treat toxic and/or recalcitrant wastes. (See also W89-02921) (Sand-PTT) W89-02926

BIOTREATMENT SYSTEMS: VOLUME III. CRC Press, Boca Raton, Florida. 1988. Vol. 3, 212p. Edited by Donald L. Wise.

Descriptors: *Water pollution, *Water treatment, *Biological treatment, *Wastewater treatment, *Biological wastewater treatment, Organic wastes,

Biotreatment Systems has as its major theme the biotreatment of organic residues. This theme pri-marily encompasses the field of anaerobic methane fermentation, with an emphasis on treatment of complex wastes. The text is intended to present a complex wastes. The text is intended to present a comprehensive overview of the most practical research programs that are being carried out in this emerging field of international significance. Volume III includes the following chapters: Anaerobic Biological Processes for the Prevention of Noxious Odors in Pulp Manufacturing; Potential for Treatment of Hazardous Organic Chemicals with Biological Processes; Anaerobic Treatment of Sulfate-Containing Waste Water; and Enhanced Biological Phosphorus Removal from Waste Waters. (See W89-02928 thru W89-02931, W89-02914, and W89-02921) (Sand-PTT)

ANAEROBIC BIOLOGICAL PROCESS FOR THE PREVENTION OF NOXIOUS ODORS IN PULP MANUFACTURING, Tohoku Univ., Sendai (Japan). Dept. of Civil En-

gineering.
G. Endo, and Y. Tohya.
IN: Biotreatment Systems. Vol. 3. CRC Press,
Boca Raton, Florida. 1988. p 1-14, 7 fig, 7 tab, 3

Descriptors: *Wastewater treatment, *Odor control, *Industrial wastewater, *Pulp and paper industry, *Anaerobic digestion, *Sulfur compounds, Bacteria, Biological wastewater treatment.

Sulfur-containing malodorous compounds in pulp-Sulfur-containing malodorous compounds in pulping waste water can be removed by an anaerobic fermentation system which is combined with an alkaline scrubbing process of fermenter gas and with an air-stripping process of fermenter gas and with an air-stripping process of the anaerobically treated water. The fundamental phenomena in an-aerobic decomposition of malodorous compounds are discussed. Optimal conditions of an anaerobic bioreactor for the treatment of foul kraft steam condensates and the secondary air stripping for the removal of the dimethyl sulfide that cannot be decomposed biologically by anaerobic microorganisms are discussed. (See also W89-02927) (Sand-PTT) PTT) W89-02928

POTENTIAL FOR TREATMENT OF HAZARD-OUS ORGANIC CHEMICALS WITH BIOLOGI-CAL PROCESSES,

Illinois Univ., Urbana. Dept. of Civil Engineering. Boca Raton, Florida, 1981, 10 Civil Engineering.

B. E. Rittmann, D. Jackson, and S. L. Storck.

IN: Biotreatment Systems. Vol. 3. CRC Press,
Boca Raton, Florida. 1988. p 15-64, 10 fig. 10 tab,
176 ref. U.S. EPA Cooperative Agreement CR.

806819 and Office of Research and Development Grant FPAR-809750

Descriptors: *Hazardous wastes, *Pollutants, *Wastewater treatment, Hazardous materials, Methane bacteria, Anaerobic treatment, Aerobic treatment, Organic compounds, Bacteria, Genetic engineering.

Biological methods for the treatment of hazardous organic chemicals are discussed, with a focus on water pollution. Following a description of the key characteristics of contamination situations, the basic concepts needed to evaluate whether or not a process is potentially capable of achieving a treatment goal are discussed. These include: the electron acceptor, the electron donor and energy source, primary and secondary substrate utilization, degradation potentials of classes of compounds, and reactor considerations. Simple quantitative models were developed that can be used to predict process performance, and examples for environmentally significant compounds demonstrate the use of the models, show several potentially valuable applications, and illustrate key features of the biological systems. The possibilities for genetic engineering to enhance biological treatment potential are also discussed. (See also W89-02927) (Sand-PTT). PTT) W89-02929

ANAEROBIC TREATMENT OF SULFATE-CONTAINING WASTE WATER.

Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands).

Apendoorn (Netherlands).
A. Rinzema, and G. Lettinga.
IN: Biotreatment Systems. Vol. 3. CRC Press,
Boca Raton, Florida. 1988. p 65-109. 12 fig, 12 tab,
193 ref.

Descriptors: "Anaerobic treatment, "Wastewater treatment, "Biological wastewater treatment, "Pulp and paper industry, "Industrial wastewater, "Sulfates, "Sulfites, Methane bacteria, Food-processing wastes, Fermentation industry, Model studies, Sulfur bacteria.

The possibilities and restrictions of the anaerobic treatment method for wastewaters containing oxidized sulfur compounds such as sulfate and sulfite are reviewed. The microbiology of sulfate reduction is discussed, with emphasis on the competition between sulfate-reducing and methane-producing bacteria. The inhibition phenomena that can be important in the anaerobic treatment of wastewater containing sulfur compounds are described. The modeling of anaerobic treatment of sulfate-containing waste waters, based on the available information on substrate competition and inhibition. is also mg waste waters, based on the available informa-tion on substrate competition and inhibition, is also discussed, along with an overview of results ob-tained with wastewater from such sources as the pulp and paper, fermentation, and edible oil indus-tries. (See also W89-02927) (Sand-PTT)

ENHANCED BIOLOGICAL PHOSPHORUS REMOVAL FROM WASTE WATERS,

Lyonnaise des Eaux, Le Pecq (France). Dept. of Wastewater Treatment.

Wastewater Freatment.
M. T. J. Meganck, and G. M. Faup.
IN: Biotreatment Systems. Vol. 3. CRC Press,
Boca Raton, Florida. 1988. p 111-203, 43 fig, 12

Descriptors: *Wastewater treatment, *Biological wastewater treatment, *Phosphorus removal, *Activated sludge, Fluidized bed process, Ion exchange, Eutrophication, Electrochemical removal, Absorption, Filtration, Chemical precipitation.

Conventional biological treatment of sewage is not sufficient to meet the low effluent phosphorus con-centrations required to prevent eutrophication of lakes and slow-flowing rivers. Specific P-removal techniques must be used, with which effluent

Group 5D—Waste Treatment Processes

standards can be met. These techniques include standards can be met. These techniques include fluidized bed crystallization, ion exchange, absorption, electrochemical P removal, treatment by algae, deep bed filtration, and chemical precipitation. Besides being rather expensive, most of these methods are 'tertiary treatment' processes requiring a good-quality biologically treated effluent as influent water. Reagent and energy needs are other disadvantages of these processes, together with the additional solids production. Sewage treatment engineers have directed their attention to alternative possibilities of P removal, and in the early 1970's it became clear that activated sludges could be induced to accumulate P un to three times more than duced to accumulate P up to three times more than necessary for normal metabolic requirements. With necessary for normal metabolic requirements. With these processes, it was possible to achieve more than 80% P removal from domestic sludges without adding any reagents and without additional sludge production. This so-called 'enhanced biological phosphorus removal' is based on the possibility of polyphosphate storage by microorganisms, and is an excellent example of the application of biotechnology to environmental protection. (See also W89-02927) (Sand-PTT) W89-02931

ENGINEERING/COST EVALUATION OF OP-TIONS FOR REMOVAL/DISPOSAL OF NC

Little (Arthur D.), Inc., Cambridge, MA. A. A. Baiasco, J. M. Nystrom, J. J. Stahr, and L. L. Smith.

L. Smith.

Available from the National Technical Information
Service, Springfield, VA 22161, as AD-A192 028.

Price codes: A04 in paper copy, A01 in microfiche.
Final Report, September 1987. 72p, 10 fig., 18 tab, 9 ref., 3 append. Army Contract DAAK11-85-D
RYVS.

Descriptors: *Wastewater treatment, *Cost analysis, *Ammunition plants, *Nitrocellulose, Centrifugation, Filtration, Incineration, Sludge, Engineering evaluation, Biological treatment, Physical

An evaluation of the various options for recovering and treating/disposing of the nitrocellulose (NC) present in the manufacturing wash streams at the Radford Army Ammunition Plant (RAAP) was undertaken for the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA). The technologies evaluated included: sliding bowl centrifugation for preconcentration; cross-flow microfiltration for final concentration; incineration for trifugation for final concentration; incineration for disposal of NC studge; and alkaline digestion for pretreatment prior to biological treatment for disposal. The evaluation focussed on the economics posal. The evaluation focussed on the economics of the various technologies, but also addressed the performance characteristics and technical risk associated with implementation of the various process options which could be configured from the evaluation of the property of the evaluation of the eval ated technologies. In carrying out the evaluation, ated technologies. In carrying out the evaluation, ten technology modules were configured and evaluated. The different modules represented variations in the expected performance of these unit operations under extremes in operating conditions. The ten modules were then configured into ten process options. The overall process options were ultimately subjected to an economic assessment and overall evaluation and ranking. The most desirable options, all involved the use of cross-flow microfiltration, as a concentrative forcewere, ten sirable options, all involved the use of cross-flow microfiltration as a concentrating/recovery step. Likewise, alkaline digestion as a method for pre-treatment prior to biological treatment/disposal was involved with the majority of the most promising options. Two of the three options with the lowest capital and operating costs also involved both cross-flow microfiltration and alkaline digestion (Author's abstract) tion. (Author's abstract) W89-02933

FATE OF WATER SOLUBLE AZO DYES IN THE ACTIVATED SLUDGE PROCESS,

Environmental Protection Agency, Cincinnati, OH. Water Engineering Research Lab. G. M. Shaul, C. R. Dempsey, and K. A. Dostal. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-208251. Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA/600/2-88/030, May 1988. 76p, 2

fig. 9 tab, 13 ref, append.

Descriptors: *Wastewater treatment, *Dye industry wastes, *Azo dyes, *Activated sludge process, Sludge digestion, Chemical analysis, Aromatic compounds, Organic compounds, Biodegradation.

Azo dyes are of concern because some of the dyes, dye precursors, and/or their degradation products such as aromatic amines (which are also dye precursors), have been shown to be, or are suspected to be, carcinogenic. Specific azo dyes were spiked at 1 and 5 mg/L to pilot-scale treatment systems with both liquid and sludge samples collected. Samples were analyzed by high performance liquid chromatography with ultraviolet-visible detector. Mass balance calculations were made to determine the percentage of the dwe compound in the waste the percentage of the dye compound in the waste activated sludge and in the activated sludge effluent. Of the 18 dyes studied, 11 compounds passed ent. Ut the 18 dyes studied, 11 compounds passed through the activated sludge process substantially untreated, 4 were significantly adsorbed onto the waste activated sludge and 3 were apparently bio-degraded. (Author's abstract) W89-02935

COMPUTER AIDED DESIGN OF DIFFUSED AERATION SYSTEMS,
Municipal Environmental Research Lab., Cincinnati, OH. Wastewater Research Div.
L. A. Rossman, and J. A. Heidman.
Available from the National Technical Information Service, Springfield, VA 22161, as PB88-185608.
Price codes: A03 in paper copy, A01 in microfice.
Report No. EPA/600/D-88/056, March 1988. 8p.

Descriptors: *Computer programs, *Aeration, *Wastewater treatment, *Design criteria, *Computer aided design, Activated sludge, Chemical oxygen demand, Dissolve oxygen, Costs.

CADDAS (Computer Aided Design of Diffused CADDAS (computer Alded Design of Diffused Aeration Systems) is a microcomputer-based pro-gram that analyzes the cost and performance of diffused aeration used in activated sludge wastewater treatment systems. The program can analyze both coarse bubble and fine pore diffusers analyze both coarse bubble and fine pore diffusers as well as detailed blower configurations and operational strategies. For a given set of hourly oxygen demands throughout the year, diffuser performance characteristics, and blower capacity/operational capability, CADAS computes hourly dissolved oxygen levels, air flow requirements, and solved oxygen levels, air flow requirements, and blower energy usage over each month of a multiyear planning period. Special attention is paid to
the effects of fine pore diffuser fouling on oxygen
transfer efficiency and its restoration through
cleaning. CADDAS also computes the present
worth costs of initial equipment installation,
monthly energy usage, annual routine maintenance, and periodic diffuser cleaning. These features make CADDAS a useful tool for identifying
cost-effective aeration system designs. (Author's cost-effective aeration system designs. (Author abstract) W89-02947

EVALUATION OF BIOLOGICAL TREATMENT OF PHARMACEUTICAL WASTEWATER WITH PAC ADDITION. VOLUME I, Radian Corp., Milwaukee, WI. D. A. Gardner, and R. A. Osantowski. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-212527. Price codes: A10 in paper copy, A01 in microfiche. Report No. EPA/600/2-88/032a, May 1988. 193p, 113 fig, 53 tab, 18 ref. EPA Contract 68-03-3371.

Descriptors: *Wastewater treatment, *Biological treatment, *Powdered activated carbon, *Chemical wastewater, *Pharmaceutical wastes, *Industrial wastewater, *Chemical oxygen demand, Standards, Activated carbon, Mixed liquor suspended solids, Suspended solids, Toxicity, Organic com-

A lack of information on applicable removal technologies for total chemical oxygen demand (TCOD) prevented promulgation of best available technology economically achievable limitations and new source performance standards for TCOD

for pharmaceutical manufacturing plants in 1983. Therefore, in 1984 EPA conducted a pilot plant study of activated carbon treatment technologies utilizing pharmaceutical wastewaters from a manufacturing plant that produces fermentation prod-ucts and chemical synthesis products. One technolucts and chemical synthesis products. One technology that was evaluated was powdered activated carbon (PAC) addition to an activated sludge system (PACT). A viscous floating mass of mixed liquor solids (VFMLS) developed in the PAC units and resulted in premature termination of the study. The purposes of this study were to: (1) attempt to find the cause of the formation of the VFMLS; (2) generate additional research data for TCOD removal from pharmaceutical wastewater using the PACT process; (3) evaluate the efficiency of PACT in removing specific organics; (4) evaluate the effectiveness of PACT in reducing effluent aquatic toxicity and (5) evaluate the use of a selector to improve the settleability of the mixed evaluate the enecuveness of FAC1 in Feducing effluent aquatic toxicity and (5) evaluate the use of a selector to improve the settleability of the mixed iquor. One control unit, two PACT units and a unit equipped with a series of selector basins for improving the settling characteristics of the mixed liquor suspended solids were operated. (Author's abstract)

EVALUATION OF BIOLOGICAL TREATMENT OF PHARMACEUTICAL WASTEWATER WITH PAC ADDITION, VOLUME II - APPEN-DICES,

Radian Corp., Milwaukee, WI. D. A. Gardner, and R. A. Osantowski. Available from the National Technical Information Avanaoie from the National Technica Information Service, Springfield, VA 22161, as PB88-212335. Price codes: A14 in paper copy, A01 in microfiche. Report No. EOA/600/2-88/032b, May 1988. 516p, 5 append. EPA contract 68-03-3371.

Descriptors: *Wastewater treatment, *Powdered descriptors: wastewater treatment, Fowdered activated carbon, *Pharmaceutical waste, *Biological treatment, *Chemical wastewater, Industrial wastewater, Chemical oxygen demand, Mixed liquor suspended solids, Suspended solids, Toxici-

By way of responding to additional information needs, from September to December 1984, EPA conducted biological and physical-chemical pilot scale performance evaluations of activated carbon scale performance evaluations of activated carbon treatment technologies utilizing actual pharmaceu-tical wastewaters. The purpose of these studies was to help evaluate the ability of these technologies to consistently achieve reductions in the effluent total chemical oxygen demand (TCOD) from fermentachemical oxygen demand (ICOD) from termenta-tion and chemical synthesis wastewaters. One of the technologies that was evaluated was powdered activated carbon (PAC) addition to an activated sludge system (PACT). Based on the initial pilot studge system (PAC1). Based on the initial pilot study results it was decided that additional biologi-cal treatment information was needed before PACT technology could be considered a viable treatment process for pharmaceutical subcategories treatment process for pharmaceutical subcategories A and C wastewaters (fermentation products and chemical synthesis products). Therefore, from March to July 1987, additional pilot biological treatment studies were performed at the site of the original 1984 pilot tests. Four biological pilot units were used in the 1987 study. One unit was operated as a control, two units were operated with powdered activated carbon added to the aeration basins, and a fourth unit was operated using a series of selector basins for improving the settling characteristics of the mixed liquor suspended solids (MLSS). This report presents the results of this characteristics of the mixed inquor suspended solids (MLSS). This report presents the results of this extensive research project. Findings are presented regarding the: (1) attempt to identify the cause of a viscous floating mass of mixed liquor solids; (2) TCOD removal by PAC addition to a biological treatment plant; (3) specific organic chemical removal; (4) aquatic toxicity removal; and (5) use of a selector system to improve the MLSS settling characteristics compared to the control. (See also W89-02948) (Lantz-PTT) W89-02949

DEVELOPMENT OF AN INNOVATIVE AND COST-EFFECTIVE MUNICIPAL-INDUSTRIAL WASTE TREATMENT SYSTEM,

Krofta Engineering Corp., Lenox, MA.

Waste Treatment Processes—Group 5D

M. Krofta, and L. K. Wang. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-168109. Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. LIR/1-85/114, April 1985. 34p, 8 fig, 10 tab, 33 ref.

Descriptors: *Wastewater treatment, *Costs, *Municipal wastewater, *Industrial wastewater, *Chemical treatment, Pilot plants, Flotation, Filtration, Ozonation, Sludge, Activated carbon, Case studies, Hoboken, New Jersey.

A new chemical waste treatment plant uses dis-solved air flotation and sand filtration for wastewater treatment, and oxygenation-ozonation, wastewater treatment, and oxygenation-zoonation, and filter press for sludge treatment. The new plant has been proven technically and economically feasible for municipal waste treatment. When treating industrial wastewater or combined municipal-industrial wastewater, tertiary treatment by granular dustrial wastewater, tertiary treatment by granular activated carbon is required. The case history of Hoboken Project involving the use of Supracell (DAF) and Sandfloat Sedifloat (DAF) and filtration) for wastewater treatment at various pollutant loadings demonstrated the technical feasibility of the process. Cost analysis indicated that the Suprathe process. Cost analysis indicated that the Supra-cell (3 min detention time) and/or Sandfloat (15 min detention time) for wastewater treatment is economically feasible. The adoption of granular activated carbon for tertiary treatment is not cost-effective. (Author's abstract) W89-02960

RECENT ADVANCES IN MAGNETIC PROC-

RECENT ADVANCES IN MAGNETIC PROC-ESSES, Lenox Inst. for Research, Inc., MA. M. Krofta, L. K. Wang, B. C. Wu, and F. Rogalla. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-168034. Price codes: A03 in paper copy, A01 in microfice. Technical Report No. LIR/04-85/129, April 20, 1005-109. 1985 28n

Descriptors: *Wastewater treatment, *Magnetic separation, *Literature review, Coagulation, Sedimentation, Filtration, Oil, Heavy metals, Patents.

Various magnetic separation processes including magnetic coagulation/sedimentation, magnetic filtration, magnetic ion exchange, and magnetite addition are presented through a literature review. Their general theory of magnetic treatment is described and its applications in water and wastewater are introduced with special emphasis on removals of oil scale and heavy metals. The information is presented as abstracts under 11 chapters; both journal articles and patents are included. (Author's abstract) W89-02961

EMISSIONS AND CONTROL OF OFFENSIVE ODOR IN WASTEWATER TREATMENT ODOR IN WASTEWATER PLANTS, Lenox Inst. for Research, Inc., MA. L. K. Wang.

L. K. Wang. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-168042. Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. LIR/04-85/130, April 23, 1985. 29p.

Descriptors: *Wastewater treatment, *Odor, *Wastewater treatment facilities, Water quality control, Literature review, Patents.

A literature review, with 96 references, of odorous A nicrature review, With 90 references, of odorous pollution sources, main odorants, odor quantification, dispersion, control methods, and health effects is presented. The report consists of abstracts of journal articles and patents. (Lantz-PTT) W89-02962

FLOTATION PROCESSES, EUSTANCE and HOROWITZ, Circleville, NY. I. J. Kumar, and W. E. Eustance. Available from the National Technical Information

Service, Springfield, VA 22161, as PB88-180302. Price codes: A04 in paper copy, A01 in microfiche. Technical Report No. LIR/03-88/284, March 1,

1988. 64p, 5 fig, 5 tab, 32 ref.

Descriptors: *Wastewater treatment, *Flotation, Flocculation, Dissolved air flotation, Odor control, Costs, Vacuum flotation.

Flotation processes include bouyance, air solubility, bubble particle contact, pressure flotation, vacuum flotation, dispersed air flotation, electro-flotation, plain flotation, and oil-water separation. Laboratory testing, pilot plants, chemical additives, chemical analysis and design examples are discussed. Air flotation methods have a definite place in wastewater treatment process lines and can offer significant advantages, especially in the treatment of naturally buoyant materials or high concentrations of poorly setting flocculant materials, of which certain industrial wastes and aeration process solids are excellent samples. The dissolved air in the flotation separation system has the additional positive benefit of abating odor problems and this is augmented by the shorter detention times when the flotation systems are compared to sedimentation operations. For other types of materials flotation may not provide removal efficiencies that would warrant the increased power and maintenance costs, even though the space requirements and initial capital cost may be less than those for a sedimentation operation. Vacuum flotation construction is generally more expensive than dispersed or pressurized air flotation because of the airtight structures required to hold a pressure of nine inches of mercury. (Lantz-PTT)

PRELIMINARY DESIGN REPORT OF A 10-MGD DEEP SHAFT-FLOTATION PLANT FOR THE CITY OF BANGOR, MAINE, USA: AP-PENDIX

PENDIX.
Krofta Engineering Corp., Lenox, MA.
Available from the National Technical Information
Service, Springfield, VA 22161, as PB88-200605.
Price codes: A06 in paper copy, A01 in microfiche.
Technical Report No. KEC/07-87/266, July 6,
1987. 171p.

Descriptors: *Flotation, *Wastewater treatment, *Wastewater treatment facilities, Bangor, Maine, Design standards, Biological treatment, Bioreac-

Two proposed 10-MGD Deep Shaft-Flotation Wastewater Treatment systems (Deep Shaft-Su-pracell System; Deep Shaft-Sandfloat System) for a planned expansion to secondary treatment at the City of Bangor, Maine are described in report No. KEKC/07-87/265. The first proposed design includes two Deep Shaft bioreactors, each 96 inches in diameter placed to a depth of 300 ft. The deep shaft reactor effluent flows to a 7290-gpm Supracell flotation clarifier 55 feet in diameter and 87 inches in total depth. The second proposed 10-MGD design also includes two Deep Shaft bioreactors (96 inches in diameter and 300 foot depth). The deep shaft reactor effluent, however, flows to a 10-MGD sandfloat clarifier 55 feet in diameter and 87 inches in total depth. Various wastewater treatment applications of Deep Shaft, Supracell and Sandfloat processes, operating data, cost data and Supracell pilot plant study at Bangor are documented for reference. (Lantz-PTT)

COMPARISON BETWEEN WASTE WATER TREATMENT IN COMPLETELY MIXED AND FLUIDIZED BED REACTORS: DEVELOPMENT AND STRUCTURE OF BIOMASS (VERGLEICH DER ABSASSERREINIGUNG IM RUHR - UND IM WIRBELBETTREAKTOR SOWIE ENTWICKLUNG UND STRUKTUR DER BIOMASSE), Kemijski Inst. Boris Kidric, Ljubljana (Yugoslav-

Name of the Control o

Descriptors: *Wastewater treatment, *Biological wastewater treatment, *Contact beds, *Aerobic digestion, *Fluidized bed process, Biomass, Water ouality control, Pharmacuitical wastes.

The aerobic biological treatment of wastewater from production of semisynthetic antibiotics in a completely mixed reactor and in a fluidized bed reactor was studied. The formation and develop-ment of new biomass on the sand of a fluidized bed was observed so that differences in the structure of was observed so that differences in the structure of organisms of the concomitant biocenosis could be detected. In a fluidized bed reactor the same quality of treated water was gained because of a 4-5 times higher volumetric and hydraulic loading as it was in the case a conventional activated sludge plant. The biocenosis of the fluidized bed was abundant in individual and species. The biofilm of the sand depended on substrate degradation rate as well as on rubbing among the sand particles. An optimal biofilm developed on the sand of a fluidized bed reactor 10 to 15 days after the experiment had begun, and that condition remained unchanged as the experiment continued. (Author's abstract) W89-03045

PROBLEMS IN CZECHOSLOVAKIA REGARD-ING METHODS OF REMOVAL OF NITRATES FROM DRINKING WATER, Ministry of Forestry and Water Conservancy,

Ministry of Forestry and Prague (Czechoslovakia). M. Chalupa.

Water Science and Technology WSTED4, Vol. 20, No. 3, p 211-213, 1988, 4 ref.

Descriptors: *Czechoslovakia, *Groundwater. *Water treatment, Biological treatment, Ground-water pollution, *Nitrates, *Denitrification, *Drinking water, Pilot plants.

Czechoslovak investigators have been studying the conditions necessary for active denitrifying organisms in the treatment of polluted groundwaters to be used for potable purposes. Heterotrophic denitrification was investigated in artificial infiltration experiments at Tlumacov in South Moravia. Laboratory, model, pilot plant, and full scale experiments were carried out in situ in the natural rock aquifer of the headwaters of the Tri Dvory and Vsetaty in Central Bohemia. Polluted surface water and groundwater were studied in the first stage of the experiments, and methyl and ethyl alcohol were tested in the second stage. The experiments confirmed that more than 90% of the NO3-N could be removed, and up to 60% of the COD could be converted to biomass or CO2. (Author's abstract)

BELT FILTER PRESS DEWATERING OF WASTEWATER SLUDGE.

TASIEMAIER SLUDGE.
American Society of Civil Engineers, New York.
Task Committee on Belt Filter Presses.
Journal of Environmental Engineering (ASCE)
JOEDDU, Vol. 114, No. 5, p 991-1006, October
1988. 11 fig, 9 tab.

Descriptors: *Wastewater treatment, *Sludge drying, *Municipal Wastewater, *Filters, *Filtration, Surveys, Belt filter presses.

In recent years, belt filter presses have become one of the most popular methods for dewatering municipal sludges. Since their performance varies with the type of sludge being dewatered, pilot testing or extrapolation of data from other facilities has been usually used to design installations. In 1984, an ASCE Task Committee on Belt Filter Presses surveyed over 100 installations to compile data on performance and operating and maintenance requirements. While many parameters can affect belt press performance, feed solids concentration was found to be the most important parameter. Good correlation between both cake solids can be used to design belt press installations and to can be used to design belt press installations and to predict performance. More accurate estimates of cake solids can be obtained if the mix of secondary and primary sludge is known. (Brock-PTT) W89-03099

DYE-SENSITIZED PHOTOCHEMICAL REDUCTION OF PCRS.

Virginia Polytechnic Inst. and State Univ., Blacks-burg. Dept. of Civil Engineering.

Group 5D—Waste Treatment Processes

M. L. Stallard, J. H. Sherrard, and M. A.

Ogliaruso.

Journal of Environmental Engineering (ASCE)

JOEDDU, Vol. 114, No. 5, p 1030-1051, October

1988. 9 fig. 6 tab, 14 ref.

Descriptors: *Polychlorinated biphenyls, *Photochemical reduction, *Waster pollution treatment, *Wastewater treatment, Chemical reduction, Transformer oils, Soils, Landfills, Leachates.

A method has been developed that can photore-duce polychlorinated biphenyl (PCB) to biphenyl with great speed and efficiency, as well as at relatively low cost. This process uses light, most likely of the visible wavelengths, generated by ordinary incandescent light bulbs, which is ab-sorbed by a common dye sensitizer. The dye mole-cules, when excited by the absorption of light, can promote a chemical reaction between PCBs and a hydrocarbon gas such as propane. In this chemical reaction, hydrogen is abstracted from the hydro-carbon gas molecule and is substituted for chlorine on the PCB molecule in a stepwise fashion, which ultimately yields the reaction product, biphenyl. This reaction occurs in a polar aprotic solvent at room temperature and is accelerated by the pres-ence of an alkali metal hydroxide. A final residence of the chlorine appears to be a salt that precipitates ence of an aixaii metal nydroxude. A final residence of the chlorine appears to be a salt that precipitates from the reaction mixture. This procedure could be applied to the treatment of PCB-contaminated transformer oils, soils, and landfill leachates. (Author's abstract) W89-03101

OFFLINE BIOREGENERATION OF GRANU-LAR ACTIVATED CARBON,
State Univ. of New York at Buffalo. Dept. of Civil

Engineering.

J. G. Goeddertz, M. R. Matsumoto, and A. S. Weber

JOEDDU, Vol. 114, No. 5, p 1063-1076, October 1988. 6 fig, 2 tab, 13 ref.

Descriptors: *Activated carbon, *Mathematical models, *Wastewater treatment, Biological wastewater treatment, Wastewater treatment, Offline biological regeneration.

feasibility of an offline biological regeneration (OBR) process for granular activated carbon is investigated. A predictive model is presented and validated with data collected from bench-scale experiments. Based on experimental results, the upper limit for regeneration efficiency will depend on the initial amount of substrate adsorbed on the carbon and the carbon's adsorption characteristics. (Author's abstract) W89-03103

PILOT-PLANT EVALUATIONS OF POROUS BIOMASS SUPPORTS, Environmental Protection Agency, Cincinnati, OH. Water Engineering Research Lab. A. Heidman, R. C. Brenner, and H. J. Shah. Journal of Environmental Engineering (ASCE) JOEDDU, Vol. 114, No. 5, p 1077-1096, October 1988. 8 fig, 6 tab, 14 ref.

Descriptors: *Activated sludge process, *Wastewater treatment, *Biological wastewater treatment, Porous Biomass support systems, Oxygen transfer efficiency, Pilot plants, Biomass.

Several porous biomass-support systems are currently available for use in the activated-sludge process. One of these systems, Captor, utilizes polyurethane foam pads to provide biofilm growth sites that transform an aerobic suspended-growth reactor into a fixed-film reactor. The pads are periodically withdrawn via a conveyor system and cleaned to remove excess biomass. A 2-year pilot-plant evaluation of the Captor biomass-support system was undertaken the U.S. Environmental Protection Agency's Test and Evaluation Facility. Three reactors were operated under various load-True reactors were operated under various load-ing conditions, dissolved-oxygen (DO) levels, and pad-cleaning frequencies in both series and parallel flow configurations. The system efficiently con-verted soluble biochemical oxygen demand (BOD)

to new biomass, but the majority of the solids exited in the process effluent rather than via the pad cleaners. Increased pad cleaning provided only marginal improvement. Nitrification was evaluated during series operation. Pad durability was good, but overall system economics were not impressive.

There was no evidence of enhanced oxygen transfer efficiencies as previously claimed. (Author's

EXPERIMENTAL STUDY OF FLOW IN SET-TLING TANKS,
Windsor Univ. (Ontario). Dept. of Civil Engineer-

For primary bibliographic entry see Field 8B. W89-03107

THERMOPHILIC ANAEROBIC DIGESTION OF WINERY WASTE (VINASSES): KINETICS AND PROCESS OPTIMIZATION, Cadiz Univ. (Spain). Dept. of Chemical Engineer-

ing. L. I. Romero, D. Sales, D. Cantero, and M. A.

Process Biochemistry PRBCAP, Vol. 23, No. 4, p 119-125, August 1988. 9 fig, 3 tab, 22 ref.

Descriptors: *Industrial wastes, *Anaerobic digestion, *Biological wastewater treatment, *Wastewater treatment, Process control, Optimization, Mathematical models, Vinasses, Winery tion, Mathematical r

Vinasses from wine-distilleries have a high organic Vinasses from wine-distilleries have a high organic contaminant load (16-25 g COD (chemical oxygen demand)/1), an acidic character (pH about 3.8), and are discharged at almost 90 C. For this reason, the thermophilic anaerobic process was examined as an alternative to the mesophilic process for the reduction of waste strength. Start-up and acclimatization of the digesters until attainment of steadytization of the digesters until attainment of steady-state conditions, and kinetic studies for the thermo-philic anaerobic process to achieve an optimum purifying performance were realized. Substrate uti-tization and methane production models, both pro-posed by Chen and Hashimoto, predicted accurate-ly the performance of the process and may be used in the design of treatment units. Once optimize ly the performance of the process and may be used in the design of treatment units. Once optimum operating conditions had been attained (at 4 days retention time and 4.25 kg COD/cu m/day load density) COD removal of 88% and 0.25 cu m CH4/kg COD added were achieved. (Author's abstract) W89-03114

SYNTROPHIC BACTERIA PROCESS TO CON-VERT A PULP MILL'S SPENT SULPHITE LIQUOR TO HYDROGEN SULPHIDE, Institut National de 12 Recherche Scientifique,

Sainte-Foy (Quebec).
D. Coullard, F. T. Tran, and R. D. Tyagi.
Process Biochemistry PRBCAP, Vol. 23, No. 2, p
69-74, June 1988. 6 fig. 3 tab, 36 ref.

Descriptors: *Biological wastewater treatment, *Pulp wastes, *Effluents, *Wastewater treatment, *Pulp and paper industry, *Spent pulping liquors, *Sulfite mills, Economic aspects, Sulfite liquors, Syntrophic bacteria, Hydrogen sulfide.

A biological process was developed to convert effluents of spent sulfite liquor (SSL) from sulfite pulping mills to hydrogen sulfide gas which can be recycled to the mill's sulfur burner. The mill's sulfur demand will thus be greatly reduced. The process is novel approach for biological treatment employing desulfurizing bacteria and Lactobacillus. in a syntrophic and synergistic system (commonly termed mutualistic system). The Lactobacillus utilizes the sugars present in the SSL as a carbon source to produce lactate as a source of food and use the hydrogen as an energy source to produce hydrogen sulfide. The purge stream of hydrogen sulfide thus produced can be recycled for sulfite pulping by burning in the mill's sulfur burner. The lignin fraction left in the medium will be precipitated, recovered and burnt for steam generation. The biotreatment will remove the bulk of organic carbon and sulfur loading from the wastewater.

Depending on the degree of treatment attainable, the treated water can be reused in the process, or discharged to the environment. The process can be cuscharged to the environment. The process can be applied to both conventional and high yield sulfite pulping effluents. An analysis of the economical viability of this process shows its competitiveness with non-biological recovery systems on the market. (Author's abstract)

INFLUENCE OF NA AND CA ALKALINITY ON UASB TREATMENT OF OLIVE MILL EF-FLUENTS: I. PRELIMINARY RESULTS,

Istituto di Ricerca sulle Acque, Bari (Italy).

A. Rozzi, N. Limoni, S. Menegatti, G. Boari, and L. Liberti.

Process Biochemistry PRBCAP, Vol. 23, No. 2, p 86-90, June 1988. 5 fig, 3 tab, 7 ref.

Descriptors: *Anaerobic digestion, *Effluents, *Olive mill effluents, *Alkalinity, *Wastewater treatment, *Food-processing wastes, *Biological wastewater treatment, Sodium, Calcium, Upflow anaerobic sludge blanket, Industrial wastes.

The influence of different alkalis NaHCO3, NaCO3, and Ca(OH)2) on the performance of Upflow Anaerobic Sludge Blanket (UASB) digesters fed on diluted olive mill effluent (OME) has been investigated at the laboratory level. Experimental results indicated that appreciable amounts of alkalimity (i.e., > or = 60 eq/cu m of feed) are needed for stable process operation at feed concentration in the range of 3-6 kg TOC/cu m (9-18 kg chemical oxygen demand/cu m). Additions of sodium alkalimity increase the bicarbonate concentration, which buffers the system and improves process stability. The main effect of lime, which can be added intermittently, is probably to enhance the settling characteristics of the anaerobic sludge. (Author's abstract)

PHOSPHATE REQUIREMENT FOR ANAERO-BIC FIXED FILM TREATMENT OF LANDFILL

Technical Univ. of Nova Scotia, Halifax, Dept. of

Technical Univ. of Nova Scotia, Hainstein Civil Engineering.
D. Thirumurthi, and G. R. Groskopf.
Canadian Journal of Civil Engineering CJCEB8, Vol. 15, No. 3, p 334-347, June 1988. 8 fig, 14 tab,

Descriptors: *Leachates, *Anaerobic digestion, *Biological wastewater treatment, *Phosphates, Fixed film reactor, Limiting nutrients, Landfills.

Three laboratory model anaerobic fixed film reactors, AFFR-A, B, and C, fed by a pretreated leachate, were monitored at 35 + or - 5 C for 10 months to estimate the effects of different concentrations and the forms of phosphate (ortho, organtrations and the forms of phosphate (ortho, organic, or condensed) on performances at 1.2-1.8 g COD (chemical oxygen demand)/(d x l) of reactor volume. Ortho-phosphate (Na3PO4) supplement was added to the feed of AFFR-A, organic phosphate (sodium glycerophophate: C3H7Na2O6P 5H2O) to AFFR-B, and condensed phosphate (Na4P2O7) to AFFR-C at a feed COD/P value of the case of the c (Na4P2O7) to AFFR-C at a feed COD/P value of about 6100 for 23 weeks (Phase 1). When no PO4 deficiency was observed, the value was increased to 7700 in reactors A and B, but the PO4 supplement was terminated for reactor C, resulting in a value of 64,300 (Phase II). The average COD of C effluent was 599 mg/L as compared with 451 and 442 mg/l for reactors A and B, respectively, suggesting that a COD/P of 64,300 was too high. During Phase III, the COD/P ratios were changed in reactors A, B, and C, respectively, to 10,200, 15,200, and 34,300. The 'optimal' ratio of COD/P lies perhaps between 15,000 and 34,300. Anaerobes did not prefer any one form or PO4 over the other two. (Author's abstract) two. (Author's abstract) W89-03132

TUNNEL AND RESERVOIR PLAN SOLUTION TO CHICAGO'S COMBINED SEWER OVER-FLOW, BASEMENT FLOODING, AND POLLU-

Waste Treatment Processes—Group 5D

Metropolitan Sanitary District of Greater Chicago,

For primary bibliographic entry see Field 4A. W89-03134

UNIT PROCESS TRADEOFFS FOR COMBINED TRICKLING FILTER AND ACTIVATED SLUDGE PROCESSES, CH2M/Hill, Denver, CO. B. W. Newbry, G. T. Daigger, and D. Taniguchi-

Journal - Water Pollution Control Federation JWFA5, Vol. 60, No. 10, p 1813-1821, October 1988. 8 fig, 4 tab, 14 ref.

Descriptors: *Biological wastewater treatment, *Wastewater treatment, *Trickling filters, *Activated sludge process, *Combined treatment, Biological oxygen demand, Kinetics, Comparison

Tradeoffs available in sizing the biological treatment components of combined trickling filter/activated sludge processes were investigated. Sixteen combinations of trickling filter total organic loading (TOL) and activated sludge mean cell residence time (MCRT) were evaluated. Soluble BOD removal was controlled primarily by the activated sludge reactor and can be characterized by first order kinetics. Effluent suspended solids concentrations are minimized by bioflocculation and subsequent degradation of particulate organic material. Trickling filter bioflocculation depends on the TOL. As TOL increases, the activated sludge MCRT (and hence the size of this component) must be increased proportionately to provide the required degree of bioflocculation and degradation of particulate organic matter. (Author's abstract) W89-03160

ANAEROBIC FLUIDIZED BED TREATMENT OF AN INDUSTRIAL WASTEWATER, National Cheng Kung Univ., Tainan (Taiwan). S. J. Chen, C. T. Li, and W. K. Shieh.
Journal - Water Pollution Control Federation JWPFAS, Vol. 60, No. 10, p 1826-1832, October 1988. 6 fig. 3 tab, 35 ref. Republic of China, National Science Council NSC75-0410-E006-14.

Descriptors: *Industrial wastewater, *Wastewater treatment, *Fluidized bed process, *Anaerobic digestion, Chemical oxygen demand, Methane bacteria, Biofilms.

The anaerobic fluidized bed biofilm reactor (AFBBR) was evaluated as a means for corn starch wastewater pretreatment. Laboratory results indicate that good chemical oxygen demand (COD) reduction and methane production are achievable in AFBBRs operated at proper food-microorganism (F:M) ratios. Over 70% of feed COD can be removed and 15 L/d of methane can be produced at F:M ratios as high as 3.45 g COD/g TVS (total volatile solids) x d. Reactor biomass holdups greater than 15,000 mg/L are achievable in AFBBRs. The combined effects of biofilm detachment, biofilm growth, and intentional bioparticle wastage and biofilm separation cause a finite AFBBR mean cell residence time (MCRT). A desirable MCRT is achievable in AFBBRs that will ensure good COD reduction and methane production. (Author's abstract) anaerobic fluidized bed biofilm reactor

ENHANCED SECONDARY TREATMENT IN-CORPORATING BIOLOGICAL NUTRIENT

REMOVAL, CH2M/Hill, Denver, CO. G. T. Daigger, G. D. Waltrip, E. D. Romm, and L. M. Morales.

Jurnal - Water Pollution Control Federation JWPFA5, Vol. 60, No. 10, p 1833-1842, October 1988. 7 fig, 4 tab, 18 ref.

Descriptors: *Secondary wastewater treatment, *Nutrient removal, *Wastewater treatment, *Biological wastewater treatment, Nitrogen removal, Phosphorus removal, Pilot plants, Cost analysis, Wastewater facilities, Virginia.

A 15-month pilot plant program tested a biological A 13-month pilot piant program tested a biological introgen and phosphorus removal concept for secondary treatment design. Part of the design was a conventional biological reactor divided into anaerobic, anoxic, and aerobic zones which are necessary to remove organic matter, nitrogen, and phos-phorus. Results indicated that enhanced nitrogen phorus. Results indicated that enhanced nitrogen and phosphorus removal could be achieved at total bioreactor hydraulic residence times as low as 3.7 hours in the summer, and at approximately 7 hours in the winter. Analyses indicated that cost impacts of the design are minimal. As a result, a new 1.75 cu m/s (40 mgd) secondary treatment facility with nutrient removal was designed with a new process, called the Virginia Initiative Plant (VIP) process. (Author's abstract) W89-03163

PILOT PLANT DEMONSTRATION OF IN-SITU BIODEGRADATION OF 1,1,1-TRICH-LOROETHANE.

RUGETHANE, Rutgers - The State Univ., New Brunswick, NJ. Dept. of Chemical and Biochemical Engineering. J. D. Boyer, R. C. Ahlert, and D. S. Kossan. Journal - Water Pollution Control Federation JWPFAS, Vol. 60, No. 10, p 1843-1849, October 1988. 5 fig, 3 tab, 22 ref.

Descriptors: *Water pollution treatment, *Biodegradation, *Chlorinated hydrocarbons, *Groundwater pollution, *Decontamination, *Cleanup, *Trichloroethane, Anaerobic treatment, Pilot plants, Soil contamination.

A pilot plant was designed, fabricated, and installed in the field based on results of a laboratory investigation on biodegradation of 1,1,1-trichloroethane from a contaminated soil sample. The laboratory experiment used glass columns packed with soil from a spill site as the bioreactors. In the field, a drought and a hurricane created difficulty with the supply of contaminated groundwater for reactor feed. Clay disaggregation and plugging also caused problems. After modifications to two pilot reactor (lysimeters), both produced effluents with 1,1,1-trichloroethane concentrations less than 20 ppb. Operating histories had marked effects on final volumetric flow rates; however, one unit surpassed design criteria throughout. As a result, in situ anaerobic biodegradation was proposed as a viable alternative for cleanup of contaminated soil and groundwater at the site under investigation. (Author's abstract)

TOXICITY OF SELECTED RCRA COM-POUNDS TO ACTIVATED SLUDGE MICRO-ORGANISMS,

Clemson Univ., SC. Dept. of Environmental Systems Engineering. V. T. Volskay, and C. P. L. Grady.

Journal - Water Pollution Control Federation JWPFA5, Vol. 60, No. 10, p 1850-1856, October 1988. 3 fig. 7 tab, 14 ref. EPA CR-813382-01-0.

Descriptors: *Toxicity, *Hazardous materials, *Resource Conservation and Recovery Act, *Activated sludge, *Wastewater treatment, *Hazardous wastes, Inhibition, Respiration, Municipal

A modified OECD Method 209, 'Activated Sludge, Respiration Inhibition Test,' was applied to 33 compounds on the RCRA list that have been found in municipal wastewaters. Fifteen of the compounds had EC50 values (concentrations reducing the oxygen consumption rate to 50% of the control) less than 1000 mg/L, and 11 had EC50 values in excess of their solubility limits. The use of dimensionless inhibition plots revealed that many of the inhibitory compounds could be characterized by simple linear, reversible, inhibition models. Provided that none of the compounds tested behave as competitive inhibitors, it appears that few of the RCRA compounds commonly in domestic wastewaters will have a large impact on activated sludge activity at the concentrations likely to be present. (Author's abstract) W89-03165

EVALUATION OF SLUDGE SETTLEABILITY BE FLOC CHARACTERISTICS,

Indian Inst. of Tech., Bombay. Centre for Envi-ronmental Science and Engineering. V. V. Sadalgekar, B. A. Mahajan, and A. M.

Shaligram.

Journal - Water Pollution Control Federation JWPFA5, Vol. 60, No. 10, p 1862-1863, October 1988. 2 tab, 8 ref.

Descriptors: *Sludge, *Activated Sludge, *Sludge volume index, *Flocculation, *Sedimentation rates, Water quality standards, India.

Water quality standards, India.

In the activated sludge process, the autoflocculative and settling capacity of sludge governs effluent quality. It is customary to indicate the successful performance of this process by the sludge volume index (SVI) or the zone settling velocity (ZSV). This work is an analysis of 30 sludge samples both from field (treating domestic and industrial wastewaters) and laboratory units (using various simulated industrial wastewaters). The analysis composed a detailed study of floc diameter, filament length, and filament number in relation to SVI to find out their correlation with settleability. Floc diameter exhibited a good correlation with SVI and can be used as an indicator for judging the performance of the process in place of SVI. Results regarding the filament length and SVI corroborate with those reported earlher. However, floc diameter is easy to measure and less subjective than filament length. Floc characteristics also predict the nature of the sludge development and settleability. (VerNooy-PTT)

PHOTODECOMPOSITION OF CHLORO-PHENOLS IN AQUEOUS MEDIUM IN PRES-ENCE OF HYDROGEN PEROXIDE,

Technische Univ. Muenchen, Freising (Germany, F.R.). Lehrstuhl fuer Oekologische Chemie. For primary bibliographic entry see Field 5B. W89-03200

USE OF REMOTE GAUGING TO MEASURE SEWER INVERT ELEVATIONS AND HEAD LOSS,

RJN Environmental Associates, Inc., College

R. B. Fernandez, E. E. Scheitlin, and J. G. vanSoestbergen.

Public Works PUWOAH, Vol. 119, No. 10, p 110-113, September 1988.

Descriptors: *Pipes, *Head loss, *Backwater, *Sewer system design, *Sewer hydraulics, Baltimore, *Maryland.

The field procedure described here is a reliable method for determining invert elevations after a sewer line has been cleaned and is relatively free of debris and other obstructions. Data obtained from this approach can further used to determine head loss in a gravity sewer line, even if the line is surcharged from a backwater line. Analysis of the field data indicates that the Westport Interceptor (Baltimore, Maryland) is subject to poor hydraulic conditions for a variety of reasons. The invert elevation of the West Low Level Interceptor is not significantly different from the invert elevation of the West Low Level Interceptor, hus resulting in significantly different from the invert elevation of the West Low Level Interceptor, thus resulting in a backwater effect and surcharging of the West-port Interceptor. Numerous sags along the of the interceptor trap flow, thus causing increased flow depth and decreased velocity through the depressions of the line, resulting in solids deposition. The average flow rate in the Westport Interceptor is not sufficient in itself to maintain adequate scouring velocities. From the observations and conclusions of the study, one recommendation that is being considered by city officials is to block the flow from the interceptor as its junction with the West Low Level Interceptor and to install a pump station at the siphon outlet. A six inch PVC force main could be threaded through the existing interceptor, which would allow the interceptor to be effectively abandoned. This would also eliminate the supplementation of t

Group 5D—Waste Treatment Processes

nate the maintenance problem of keeping the inter-ceptor open. (Miller-PTT) W89-03280

WASTEWATER IRRIGATION OF VEGETABLE Univ., Lafayette, IN. Dept. of Horticul-

ture. For primary bibliographic entry see Field 5E. W89-03282

ROLE OF PROTOZOA IN MICROBIAL ACCLIMATION FOR MINERALIZATION OF ORGANIC CHEMICALS IN SEWAGE, Cornell Univ., Ithaca, NY. Dept. of Agronomy. B. A. Wiggins, and M. Alexander. Canadian Journal of Microbiology CJMIAZ, Vol. 34, No. 5, p 661-666, May 1988. 6 fig. 1 tab, 17 ref.

Descriptors: *Protozoa, *Biodegradation, *Wastewater treatment, *Organic compounds, *Mineralization, *Acclimatization, Chemical deg-radation, Microbiological studies, Bacteria, Antibiotics, Predation, Microbial degradation.

The role of protozoa in affecting the length of the acclimation period for the mineralization of 2 ng of nitrophenol, 100 ng of 2,4-dichlorophenoxyacetic acid, and 100 ng of 2,4-dichlorophenol per ml were markedly shortened or eliminated when the indigenous protozoa were inhibited with cycloheximide and nystatin. The extent of mineralization of the and hystatin. The extent of mineralization of the test compounds decreased when the protozoa were suppressed. Inhibition of the protozoa increased the total number of bacteria and the density of organisms able to mineralize 2 ng of p-nitrophenol per ml of sewage. Addition of Tetrahymena therper mi of sewage. Addition of retranymena ther-mophila to sewage in which the indigenous proto-zoa were not active lengthened the acclimation period for the mineralization of p-nitrophenol. The addition of T. thermophila to a culture containing addition of T. thermophila to a culture containing a low density of a p-nitrophenol-degrading Pseudomonas sp. did not affect the acclimation period prior to mineralization of the substrate, but the ciliate increased the acclimation period in the presence of high densities of Enterobacter aerogenes added as an alternative prey species. Protozoan grazing may be responsible for the acclimation period prior to the mineralization of certain organic compounds in sewage. (Author's abstract) W89-03283

MEMBRANE SEPARATION TECHNOLOGIES FOR TREATMENT OF HAZARDOUS WASTES, Environmental Strategies Corp., San Jose, CA

CRC Critical Reviews in Environmental Control CCECAU, Vol. 18, No. 2, p 91-131, 1988. 16 fig, 9 tab. 106 ref.

Descriptors: *Membrane processes, *Wastewater reatment, *Membrane processes, *Reverse osmo-sis, Ultrafiltration, Electrodialysis, Economic as-pects, *Cost analysis, Wastewater, Hazardous

The potential of membrane separation technologies for treating hazardous wastes is discussed. Reverse osmosis effectively removes dissolved inorganics and high molecular weight organics from aqueous waste streams. It is generally applicable for treat-ment of wastes with total dissolved solids concentrations of up to 50,000 mg per sq l. Ultrafiltration is similar to reverse osmosis in that it is a pressuredriven membrane separation technology. However, ultrafiltration systems operate at lower pressures than reverse osmosis units and remove only high molecular weight compounds. Unlike reverse osmosis, ultrafiltration is not capable of removing onaicosa, unanitation is not capacie or removing ionic compounds. Instead of driving pure water through a membrane and leaving contaminants behind, electrodialysis is a process in which ions are selectively transported through semipermeable are selectively transported through semipermeable membranes from one solution to another under the influence of a direct current electrical field. The economic feasibility of membrane separation is one of the major factors that determines whether those technologies will be applied in hazardous waste treatment applications. Although costs depend on site-specific conditions certain factors should be

taken into consideration. A comparison of reverse osmosis and electrodialysis is presented with costs (or savings) in terms of dollars of hazardous waste land disposal if the membrane separation process were implemented. This information suggest that electrodialysis recovery of cadmium, nickel, and zinc and reverse osmosis recovery of nickel, cadmium and chromium are less costly than land disposal. Three innovative separation technologies are also discussed: (1) micellar-enhanced ultrafiltradisposal. Inter limovative separation terminologies are also discussed: (1) micellar-enhanced ultrafiltration; (2) the Aquatech electrodialysis process; and (3) liquid membranes. Fouling of membrane surfaces is one of the major practical limitations on naces is one of the major practical infiliations on the use of reverse osmosis and ultrafiltration for the treatment of hazardous wastes. Membrane materials also need to be developed that will reject small, unionized organics and withstand higher operating temperatures (149 F or 65 C and higher). (Miller-FTT)

NEW POROUS POLYMER FOR OFF-LINE PRECONCENTRATION OF CHLOROPHEN-OLS FROM WATER, Marie Curie-Sklodowska Univ., Lublin (Poland).

For primary bibliographic entry see Field 5A. W89-03286

SEWAGE HARDNESS AND MORTALITY FROM CANCER AND CARDIOVASCULAR

Morehouse School of Medicine, Atlanta, GA. Dept. of Community Health/Preventive Medicine. J. F. C. Sung, G. vanBelle, J. A. H. Lee, F. B. DeWalle, and A. E. Nevissi.

Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 4, p 489-495, October 1988. 3 tab, 17 ref.

Descriptors: *Wastewater analysis, *Water quality effects, *Hardness, *Water quality effects, *Heart disease, *Municipal water, *Drinking water, Human diseases, Mortality, Cancer, Carcinogens, Calcium, Magnesium.

A comprehensive analysis was conducted of 24-hour flow composite sewage and sludge samples taken from 25 Standard Metropolitan Statistical Areas in the US. Sewage treatment methods were Areas in the US. Sewage treatment methods were considered in selecting study areas. Measures of hardness and its major determinants, calcium and magnesium, were included. The hardness of sewage can well reflect the average hardness of municipal drinking water. Attempts to test the association of sewage hardness with mortality from cancer, in addition to mortality from cardiovascucancer, in addition to mortainty from cardiovascular disease, among these areas are reported. A negative relationship between sewage hardness and ischemic heart disease for males, was consistent with other findings from studies of drinking water hardness. This suggests that the analysis of sewage is a valid, if indirect, measure of important environments. is a valid, if indirect, measure of important environ-mental variables. The more interesting findings are the negative partial correlations between sewage hardness characteristics and leukemia for males, at 0.01 level, and prostate cancer, at 0.05 level. The other striking finding is the partial correlation neg-atively relating hardness and total cancer death. However, other variables are also good predictors in the regression. The percent of the population who smoked or worked in the manufacturing in-dustry in an area were as important as hardness dustry in an area were as important as hardness characteristics for males in the prediction. The percent of population that was non-white and educated were also important variables. (Miller-PTT) W89-03309

PROMISING TECHNOLOGIES FOR THE BIO-LOGICAL DETOXIFICATION OF HAZARD-OUS WASTE.

Environmental Protection Agency, Cincinnati, OH.

A. A. Ofaser.

Available from the National Technical Information Service, Springfield, VA 22161, as PB88-173356. Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA/600/D-88/040, February 1988. 12p, 27 ref.

Descriptors: *Hazardous wastes, *Biological treatment, *Wastewater treatment, *Waste disposal, *Cleanup operations, Organic compounds, Costs, Biodegradation, Fungi, Water pollution prevention, Soil contamination, Pentachlorophenol, Creosote, Wood wastes.

There are, under development, a number of new biological technologies that target the cleanup of contaminated hazardous waste sites. These tech-nologies utilize specific organisms to degrade oranic chemical contaminants to less toxic species. The attraction to this new area of treatment in the United States is the restrictions on waste burial, costs of conventional alternative technology, and the assumption that biological processes are more environmentally agreeable. Two areas of develop-ment discussed are the use of white rot fungus ment discussed are the use of white rot lungus wood degrader for water and soil treatment and a pentachlorophenol degrader. The white rot based treatment is focused on the treatment of wood treating wastes, i.e. creosote, pentachlorophenol and associated materials. (Author's abstract) W89-03322

MUNICIPAL WASTEWATER TREATMENT TECHNOLOGY TRANSFER ACTIVITIES OF THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY,

Environmental Protection Agency, Cincinnati, OH. Water Engineering Research Lab. J. J. Convery, J. F. Kreissl, A. D. Venosa, J. H. Bender, and D. Lussier.

pender, and D. Lussier.
Available from the National Technical Information
Service, Springfield, VA 22161, as PB88-171426.
Price codes: A03 in paper copy, A01 in microfiche.
Report No. EPA/600/D-88/032, February 1988.
14p, 1 fig, 2 tab, 28 ref.

Descriptors: *Technology transfer, *Wastewater treatment, *Municipal wastewater, Case studies, Disinfection, Ultraviolet radiation.

Technology transfer is an important activity within the U.S. EPA. Specific technology transfer programs such as the activities of the Center for Environmental Research Information, the Innovative and Alternative Technology Program as well as the Small Community Outreach Program are used to encourage the utilization of cost-effective municipal pollution control technology. Case studies of three technologies including a plant operations diagnostic/remediation methodology, alternative sewer technologies and ultraviolet disinfection are presented. These case studies are presented native sewer technologies and ultraviolet disinfec-tion are presented. These case studies are presented retrospectively in the context of a generalized con-cept of how technology flows from science to utilization. Additional insights from this study are presented on the information gathering characteris-tics of engineers and scientists which may be useful in designing technology transfer programs. The recognition of the need for a technology or a deficiency in current practice are important stimuli other than technology transfer for accelerating the other than technology transfer for accelerating the utilization of new technology. (Author's abstract) W89-03325

BOD AND NUTRIENT REMOVAL BY BIO-LOGICAL A/O PROCESS SYSTEMS, Lenox Inst. for Research, Inc., MA.

L. K. Wang, M. H. S. Wang, and D. B.

Available from the National Technical Information Service, Springfield, VA 22161, as PB88-168430. Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. LIR/12-86/207, December 1, 1986. 12p, 6 fig, 3 tab.

Descriptors: *Biochemical oxygen demand, *Nutrients, *Wastewater treatment, Anaerobic digestion, Aerobic treatment, Phosphorus, Denitrification, Nitrification, Organic carbon, Nitrogen, Sludge digestion.

The experimental data of a 3-MGD anaerobic/ The experimental data of a 3-MGD anaerobic/ oxidation (A/O) process demonstration plant in Largo, Florida, was generated by Air Products, Allentown, Pennsylvania, and is analyzed and pre-sented by the authors. Two A/O process systems are introduced: (1) A/O process for biochemical

Ultimate Disposal Of Wastes-Group 5E

oxygen demand (BOD) and phosphorus removal; and (2) A/O process with nitrification and denitrification. More specifically the A/O process systems are defined and graphically illustrated. Largo plant's influent characteristics, operating parameters, effluent characteristics and removal efficiencies are presented. It is concluded that high removals of organic carbon, nitrogen and phosphorus from the process stream can all be achieved in a single-sludge A/O process system. (Author's abstract) stract) W89-03326

BIOLOGICAL WASTEWATER TREATMENT OF AZO DYES, Environmental Protection Agency, Cincinnati, OH. Water Engineering Research Lab. G. M. Schaul, C. R. Dempsey, and K. A. Dostal. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-213709. Price codes: Ad2 in paper copy, Ad1 in microfiche. Report No. EPA/600/D-88/084, May 1988. 3p.

Descriptors: *Wastewater treatment, *Biological wastewater treatment, *Azo dyes, Industrial wastewater, Dyes, Aromatic compounds, Amines, Organic compounds, Fate of pollutants, Monitor-

Azo dyes constitute a significant portion of Premanufacture Notification (PMN) submissions and specific azo dyes have recently been added to the EPA priority list for considerations in the development of test rules under Section 4 of the toxic Substances Control Act. Azo dyes are of concern Substances Control Act. Azo dyes are of concern because some of the dyes, dye precursors, and/or their degradation products such as aromatic amines (which are also dye precursors) have been shown to be, or are suspected to be, carcinogenic. The fate of azo dyes in biological wastewater treatment systems was studied to aid in the review of PMN. systems was studied to aid in the review of FMn submissions and to assist in the possible development of test rules. Extensive pilot-scale activated sludge process testing for 18 azo dyes and from fate studies of C.I. Disperse Blue 79 in aerobic and anaerobic wastewater treatment were performed but the results are not presented in this report. (Lantz-PTT) W89-03327

STRINGFELLOW LEACHATE TREATMENT

STRINGFELLOW LEACHATE TREATMENT WITH RBC, Environmental Protection Agency, Cincinnati, OH. Hazardous Waste Engineering Research Lab. E. J. Opatken, H. K. Howard, and J. J. Bond. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-170105. Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA/600/D-88/013, February 1988. 17p, 5 fig, 2 tab, 6 ref.

Descriptors: *Hazardous wastes, *Wastewater treatment, *Rotating biological contactor, *Leachates, *Biological wastewater treatment, *String-fellow Hazardous Waste Site, California, Primary effluents, Organic compounds, Organic carbon.

A study was conducted with a rotating biological contactor (RBC) for treatment of leachate from contactor (RBC) for treatment of leachate from the Stringfellow hazardous waste site in Riverside County, California. The leachate was transported from California to Cincinnati, where a pilot sized RBC was installed at the EPA's Testing and Evaution (T and E) Facility. A series of kinetic runsmade with primary effluent from the City of Cincinnati's Mill Creek Sewage Treatment Plant to develop a biomass on the disks and to obtain a standard kinetic removal rate. These runs were then followed with Stringfellow leachate experistandard kinetic removal rate. These runs were then followed with Stringfellow leachate experiments that included: Operations at various ratios of leachate to primary effluent; Operations at 100% leachate; Operations to increase the percentage removal of dissolved organics. The study on treating Stringfellow leachate with a RBC showed that: 65% of the dissolved organic carbon (DOC) can be removed by biological treatment; the residuals remaining after biological treatment will require further processing with activated carbon to achieve levels below 100 mg DOC/L; The direct scaleup of the pilot plant result to the Stringfellow site would require 3.3 years of operation to recover

the capital costs for a RBC treatment stage; and a modified design scaleup based on satisfying the reaction time requirements is an attractive alternative to reduce capital costs and thus reduce the capital cost recovery period from 3.3 years to 1.1 years. (Lantz-PTT) W89-03328

5E. Ultimate Disposal Of Wastes

COMBINED FIXED BIOLOGICAL MEDIA AND EVAPORATIVE COOLING
MEDIA TO SOLIDIFY HAZARDOUS WASTES
FOR ENCAPSULATION AND EFFICIENT DIS-POSAL.

For primary bibliographic entry see Field 5D. W89-02294

HAZARDOUS WASTE RESEARCH PERTAIN-ING TO METAL FINISHING,

Environmental Protection Agency, Cincinnati, For primary bibliographic entry see Field 5G. W89-02393

LIABILITY FOR MANAGING HAZARDOUS WASTES: PAST, PRESENT AND FUTURE, Wolf, Block, Schorr and Solis-Cohen, Philadel-phia, PA. For primary bibliographic entry see Field 6E. W89-02398

HOW CLEAN IS CLEAN, (WHAT CONSTI-TUTES THE CLEAN CLOSURE OF A HAZ-ARDOUS WASTE LAND MANAGEMENT FA-CILITY).

CILITY),
HRP Associates, Inc., New Britain, CT.
W. J. Gancarz, and M. C. Possidento.
IN: 8th AESF/EPA Conference on Pollution
Control for the Metal Finishing Industry. EPA
Report No. EPA/600/9-87/012, July 1987. p 88105, 6 tab, 4 ref.

Descriptors: *Cleanup operations, *Hazardous wastes, *Waste disposal, *Waste management, *Land disposal, Groundwater quality, Case studies, Landfills, Aquifers, Metal-finishing wastes,

The following issues are considered key components in addressing proper disposal of hazardous wastes: (1) Listed versus Characteristic Wastes or what makes a waste hazardous; (2) The effect of the wastes and residues on existing groundwater quality and present and future groundwater users; (3) The limited availability of permitted secure landfills for waste disposal; and (4) Economics. These issues are illustrated in three case histories. There is no simplification of the problem facing many small electroplaters who wish to close their land management facilities. The issues and general recommendations of this paper are: (1) The need for secure landfill disposal of contaminated soils should be based on hazard potential as defined by the results of an EPA Toxicity test and not arbitrarily required because the source was a listed waste; (2) The limit of contaminated soil removal should be based on the potential health hazard and effect on the environment associated with leaving should be based on the potential health hazard and effect on the environment associated with leaving some contaminated soil in place. It is extremely difficult, costly and in some cases virtually impossible to remove all contaminated soil down to background levels; and (3) Groundwater discharge limits associated with a closed surface impoundment should be assigned on a realistic basis, again considering background water quality, and the existing and potential aquifer uses. (See also W89-02392) (Lantz-PTT) W89-02392.)

CONTRIBUTION OF TOXIC CHEMICALS TO GROUNDWATER FOR DOMESTIC ON-SITE SEWAGE DISPOSAL SYSTEMS, Connecticut Univ., Storts. Inst. of Water Re-

For primary bibliographic entry see Field 5B. W89-02584

METAL SPECIATION AND INTERACTIONS AMONG ELEMENTS AFFECT TRACE ELE-MENT TRANSFER IN AGRICULTURAL AND ENVIRONMENTAL FOOD-CHAINS,

Agricultural Research Service, Beltsville, MD. Soil-Microbial System Lab. For primary bibliographic entry see Field 5B. W89-02650

ECONOMIC AND ENVIRONMENTAL IM-PACTS OF USING MUNICIPAL SEWAGE EF-FLUENT FOR AGRICULTURAL PRODUC-

Oklahoma State Univ., Stillwater. Dept. of Agricultural Econom

Colluma Economics.

D. D. Badger, and D. E. Thomason.

IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p.

111-126, 3 tab, 17 ref. Oklahoma Agricultural Exeriment Station Hatch Project 1906

Descriptors: *Municipal wastewater, *Land disposal, *Water reuse, *Land treatment, *Wastewater, *Agriculture, Oklahoma, Irrigation, Economic aspects, Environmental effects.

The economic and water-quality effects of the wastewater treatment land application of municipal sewage effluent on farmers and municipalities was analyzed. The economic and environmental impacts of the land application of municipal sewage effluent was also examined. Land application of municipal sewage effluent in a crop or pasture irrigation system designed to increase agricultural production while providing acceptable levels of treatment of the effluent. Land application treatment systems in Oklahoma generated benefits tooth the farmer and the municipality. Farmers obtained a more stable water source compared to dependence on rainfall, and municipal sewage effuent gave farmers another source of nitrogen, dependence on rainfall, and municipal sewage effluent gave farmers another source of nitrogen, phosphorus, and potassium. A problem of handling a waste was turned into a situation where a waste product was used and reclaimed. Problems with land application systems included: seasonal supply fluctuations, seepage and erosion in cell walls and dikes, design error, malfunctioning irrigation equipment, and more wastewater to be stored than capacity for holding it. System management and cooperation between city and farmer are crucial to the success of land application. (See also W89-02654) (Davis-PTT)

REGULATION OF THE AGRICULTURAL UTI-LIZATION OF SEWAGE SLUDGE IN NEW

New Jersey Dept. of Environmental Protection, Trenton. Residuals Management Section. A. Fekete, and H. Pettit-Chase.

IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p 329-344, 2 fig, 6 tab, 2 ref.

Descriptors: *New Jersey, *Agriculture, *Regula-tions, *Sludge, *Land disposal, Soil properties, Quality control, Monitoring, Groundwater.

New Jersey is a small but densely populated state with over 500 domestic and privately owned sewage treatment plants, which produce over 2.3 million dry pounds of sludge per day. Traditional sludge management disposal practices are disappearing, and being replaced by resource recovery management alternatives. Groundwater is used extensively throughout New Jersey for public, industrial, domestic, and agricultural supply. Most activities which may affect the quality of this natural resource are strictly regulated, including the agricultural utilization of sewage sludge. The New Jersey Solid Waste Management Act provides for the maximum practical processing of all sludge into energy, fertilizers, and other useful products. The agricultural utilization of sludge is regulated under the authority of the New Jersey Water Pollution Control Act. The New Jersey Water Pollution Control Act. The New Jersey Residuals Management Program provides two opportunities Management Program provides two opportunities of resource recovery and reuse through agricultural use: the Land Application Program and the Distribution Program. Under the Distribution Pro-

Group 5E-Ultimate Disposal Of Wastes

gram a specific sludge product is identified and evaluated for its suitability for distribution. Under grain a specific studies by the devaluated for its suitability for distribution. Under the Land Application Program, a specific site is identified and evaluated for its suitability or long-term land application of sludge. New Jersey Pollutant Discharge Elimination System Permit conditions are related to the impact that land application of sludge might have on public health and on ground and surface water quality. The environmental safeguards provided in land application permits are based in large part on sludge quality determinations. Through a procedure known as the Generic Quality Determination, sewage treatment plants can gave their sludge quality evaluated for suitability for agricultural utilization. Upon completion of the review, the treatment plant is issued a letter which indicates that their sludge is suitable or unsuitable for land application and suitable or unsuitable for land application and specifies if additional stabilization will be required in order to meet standards. Insufficient data exists for the majority of the 21 permitted sludge farms in New Jersey since most have been operating only since March 15, 1985. (See also W89-02654) W89-02676

WASTEWATER CHARACTERIZATION AND HAZARDOUS WASTE SURVEY, CASTLE AFB,

Air Force Occupational and Environmental Health Lab., Brooks AFB, TX. For primary bibliographic entry see Field 5D. W89-02704

SUPERFUND RECORD OF DECISION:

SUPERFUND RECORD OF DECISION: DISTLER FARM, KY. Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response. For primary bibliographic entry see Field 5G. W89-02778

WASTE MINIMIZATION AUDIT REPORT: CASE STUDIES OF MINIMIZATION OF MER-CURY-BEARING WASTES AT A MERCURY CELL CHLORALKALI PLANT,

Versar, Inc., Springfield, VA. M. Drabkin, and E. Rissmann.

M. Litakin, and E. Rissmann.
Available from the National Technical Information
Service, Springfield, VA. 22161, as PB88-16679.
Price codes: A66 in paper copy, A01 in microfiche.
Report No. EPA/600/2-88/011, February 1988.
94p, 16 fig, 13 tab, 19 ref. EPA Contract 68-01-7053.

Descriptors: *Waste management, *Mercury, *Waste disposal, *Industrial wastes, Sludge, Wastewater treatment, Landfills, Case studies.

To foster programs to reduce the genereation of hazardous waste EPA's Office of Research and Development Hazardous Waste Environmental Research Laboratory (ORD/HWERL) is supporting the development and evaluation of a model hazardous waste minimization audit (WMA) procedure using the EPA hierarchy of waste minimization (WM) options, with source reduction being more desirable and recycle/reuse less desirable. Treatment ontions, although not considered WM. zation (WM) options, with source reduction being more desirable and recycle/reuse less desirable. Treatment options, although not considered WM, were evaluated if neither of the former alternatives was available. The procedure was tested initially in several facilities in 1986 WMAs were conducted at generators of a number of generic hazardous wastes, including corrosives, heavy metals, spent solvents, and cyanides. In 1987, the HWERL WMA program has concentrated on ORD's top priority K and F waste list. Audits were conducted at generators of K071 and K106 wastes (nercury cell chloralkali plants), K048-K052 wastes (sludges and solids from petroleum refining), F002-F004 wastes (spent solvents), and F006 wastes (wastewater treatment sludges from electroplating operations). The present report covers WMAs carried out at two mercury cell chloralkali plants (designated as Plant No. 1 and Plant No. 2) seeking to develop WM options for K071 and K106 wastes. The audit team was able to develop only one technically and economically visible source wastes. The author team was able to develop only one technically and economically viable source reduction option for K071 waste. Two treatment options (although not considered WM) appeared to be technically and economically viable for this

waste, allowing it to be delisted by EPA and thus disposable in a local sanitary landfill. No viable source reduction or recycle/reuse options were available for K106 waste with one possible exception—a retorting process which appears capable of meeting delisting levels for mercury in the retorted K106 residue has been successfully tested by Plant No. 1. (Author's abstract) W89-02821

SUPPLEMENTAL FINAL DEVELOPMENT DOCUMENT FOR EFFLUENT LIMITATIONS GUIDELINES, NEW SOURCE PERFORMANCE STANDARDS AND PRETREATMENT STANDARDS FOR THE LEATHER TANNING AND FINISHING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, DC. Industrial Technology Div. For primary bibliographic entry see Field 6E. W89-02832

USE AND DISPOSAL OF MUNICIPAL WASTEWATER SLUDGE. Environmental Protection Agency, Cincinnati, OH. Center for Environmental Research Informa-

tion.
Available from the National Technical Information Service, Springfield, VA 22161, as PB88-186754. Price codes: A04 in paper copy, A01 in microfiche. September 1984. 96p, 32 fig, 16 tab, 45 ref.

Descriptors: *Waste disposal, *Wastewater disposal, *Sludge disposal, *Municipal wastewater, Fertilizers, Sludge, Land disposal, Landfilling, Incineration, Ocean dumping, Water reuse.

The need for effective sludge management is continual and growing. The quantity of municipal sludge produced annually has almost doubled since 1972, when the Clean Water Act imposed uniform minimum treatment requirements for municipal wastewater. In addition, the sludges generated by wastewater. In authors, the studies generated by more advanced treatment are more difficult to handle than the sludges produced by less advanced treatment. When properly used, sludge can be a valuable resource as a soil conditioner and partial fertilizer and as a source of methane for producing energy. The EPA, the primary Federal regulatory agency responsible for sludge management, encourages the beneficial use of sludge whenever environmentally feasible. The five major sludge use/disposal options currently available: land application, distribution and marketing of sludge products, landfilling, incineration, and ocean disposal are described factors influencing their selection and implementation are discussed, and an initial framework is provided for evaluating sludge use/disposal alternatives. (Lantz-PTT) more advanced treatment are more difficult to

EVALUATION OF MUNICIPAL WASTE LANDFILL COVER DESIGNS, SOLID

Battelle Columbus Div., OH.
J. R. Dwyer, J. C. Walton, W. E. Greenberg, and R Clark

R. Clark.

Available from the National Technical Information
Service, Springfield, VA 22161, as PB88-171327.

Price codes: A06 in paper copy, A01 in microfiche.
Report No. EPA/600/2-86/110, December 1986.

118p, 35 fig, 5 tab, 24 ref, 5 append. EPA Contract
68-03-3248.

Descriptors: *Performance evaluation, *Municipal wastes, *Solid waste disposal, *Landfill cover, *Design criteria, *Water pollution prevention, *Landfill, *Waste disposal, Model studies, Hydrologic Evaluation of Landfill Performance Model, Landfill, *Respectability, acofficiers, Solid. Leaching, Permeability coefficient, Soil types, Runoff, Percolation, Evapotranspiration, Clays,

The HELP (Hydrologic Evaluation of Landfill Performance) Model was used to evaluate the hy-drologic behavior of a series of one-, two-, and drologic behavior of a series of one, two, and three-layer cover designs for municipal solid waste landfills with climatic conditions for 10 U.S. cities. The specific landfill cover designs were chosen to isolate the effects of features such as surface vege-tation, thickness, soil types and hydraulic conduc-

tivity of the layers on the average annual runoff, cover percolation, evapotranspiration, and lateral drainage. For the one-layer type covers, cover percolation is reduced as the soil type of the cover percolation is reduced as the soil type of the cover ranges from coarse-textured (sandy) soils to fine-textured (clayey) soils. Cover percolation for one-layer covers using a clay-loam soil is < 5 inches at 4 cities where average annual precipitation is < 33 inches. For two-layer covers consisting of a 6 inch gravel layer over a clay barrier, cover percolation is < 1.7 inches for all 10 cities tested. Runoff is relatively high for this type, ranging from 1.6 to 24 inches for the 10 cities. For two-layer covers coninches for the 10 cities. For two-layer covers consisting of a topsoil layer over a clay barrier, cover percolation is slightly reduced as the soil texture of the topsoil layer is reduced from coarse to fine. Cover percolation is increased by 0.6 to 0.8 inches when the thickness of the clay barrier layer is reduced from 24 to 12 inches. Cover percolation is reduced by approximately a factor of 10 when the hydraulic conductivity of the barrier layer is reduced by a factor of 10. The HELP Model results indicate that these cover types experience periodic duced by a factor of 10. The HELP Model results indicate that these cover types experience periodic saturation of the topsoil layer during the periods of record for the 10 cities tested (10 to 20 years). For three-layer covers consisting of a topsoil layer, a drainage layer, and a clay barrier, cover percolation is reduced by 0.25 to 0.55 inches when clay loam instead of sandy loam is used in the topsoil layer. Reducing the hydraulic conductivity of the drainage layer by a factor of 8.4 results in an increase in cover percolation ranging from 0.5 to increase in cover percolation ranging from 0.5 to 0.9 inches for the 10 cities. (Lantz-PTT)

MUNICIPAL WASTEWATER SLUDGE COM-BUSTION TECHNOLOGY. Environmental Protection Agency, Cincinnati, OH. Center for Environmental Research Informa-

For primary bibliographic entry see Field 5D. W89-02872

AEROBIC TREATMENT OF SEWAGE FROM LIGNITE (BROWN COAL) PROCESSING,

Institut fuer Biotechnologie, Leipzig (German For primary bibliographic entry see Field 5D. W89-02915

BACTERIAL LEACHING OF HEAVY METALS FROM ANAEROBICALLY DIGESTED SLUDGE,

Esso Petroleum Canada, Sarnia (Ontario). Research Dept. For primary bibliographic entry see Field 5D. W89-02925

BIODEGRADATION OF RECALCITRANT IN-DUSTRIAL WASTES,

National Environmental Engineering Research Inst., Nagpur (India). For primary bibliographic entry see Field 5D. W89-02926

FACTORS IN ASSESSING THE COMPATIBIL-ITY OF FMLS AND WASTE LIQUIDS,

ITY OF FMLS AND WASTE LIQUIDS, Matrecon, Inc., Alameda, CA. H. E. Haxo, T. P. Lahey, and M. L. Rosenberg. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-173372. Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA/600/2-88/017, February 1988. 143p, 22 fig, 47 tab, 45 ref, 9 append. EPA Contract 68-03-3213.

Descriptors: *Waste storage, *Waste disposal, *Membrane liners, *Liners, Volatile organic compounds, Leaching, Organic compounds, Polymers,

This experimental research project studied various factors in the compatibility of flexible membrane liners (FMLs) with waste liquids and other hazardous substances that may be encountered in waste storage and disposal facilities. Equilibrium swelling of 28 FML-related polymeric compositions was

Ultimate Disposal Of Wastes-Group 5E

determined in 30 organics and deionized water. These 28 polymeric materials included thermoplastic, crosslinked, and semicrystalline compositions, of which 22 were commercial FMLs or sheetings and six were known compositions prepared in the laboratory for this study. Basic polymer and compound variations (e.g., differences in polymer type, level of crystallinity, crosslink density, filler level, and amount and type of plasticizer) were assessed. The 30 organics covered a wide range of Hilderand solubility parameters as well as the component solubility parameters as well as the component solubility parameters are component solubility parameters are component solubility parameters. Crystallinity of the base polymer appears to be the dominant factor in reducing the swelling of an FML or an FML-related composition in all of the organics and to override both the solubility parameters and crosslinking. Dissolved organics will transfer from a dilute aqueous solution to an FML with which the solution is in contact and will diffuse through to the opposite side of the FML. In conducting compatibility tests of waste liquids that contain volatile organics, it has been found necessary, in order to simulate the effects of actual exposure, to prevent the loss of these organics from the time the leachate is sampled in the field through the actual test of exposed FML specimens. The results indicate the desirability of changing the waste at the beginning of each month of testing in order to maintain concentrations of the organics. (Lantz-PTT) determined in 30 organics and deionized water.

TREATMENT OF OIL AND OILY WASTES, Norges Tekniske Hoegskole, Trondheim. Selskapet for Industriell og Teknisk Forskning. For primary bibliographic entry see Field 5G. W89-02963

U.S. PRODUCTION OF MANUFACTURED GASES: ASSESSMENT OF PAST DISPOSAL PRACTICES, Research Triangle Inst., Research Triangle Park,

NC.
S. M. Harkins, R. S. Truesdale, R. Hill, P.
Hoffman, and S. Winters.
Available from the National Technical Information
Service, Springfield, VA 22161, as PB88-165790.
Price codes: A18 in paper copy, A01 in microfiche.
Report No. EPA/600/2-88/012, February 1988.
388p, 76 fig, 72 tab, 504 ref. EPA Contract 68-01-6826 D.O. 35.

Descriptors: *Gas manufacturing, *Water pollution sources, *Waste disposal, *Environmental effects, *Industrial wastes, Groundwater pollution, Toxicity, Water pollution effects, Case studies, Hydrocarbons, History, Site remediation.

Former sites of gas manufacture present problems for remediation and reuse. In some cases, polluted groundwater and surface waters are near the sites. The history of the manufactured-gas industry of the United States, its production processes, disposal trends, waste toxicity, methods of site investigation, and the current status of manufactured-gas sites was examined. The report is intended as a guide to those who are examining and evaluating manufactured-gas sites for either environmental risks or possible remediation. Six manufactured-gas sites and one spent oxide disposal area were visited during the project, and case studies were prepared during the project, and case studies were prepared for six former gas-manufacturing sites, two by-product tar utilization facilities, a creosoting plant and a coal tar processor. The current status of manufactured-gas sites in the United States was determined by contacting State and regional environmental officials and by discovering how their regions were treating manufactured-gas sites. (Author's abstract) W89-02964

SUPERFUND RECORD OF DECISION: KANE AND LOMBARD, MD.

AND LOMBARD, MD.
Environmental Protection Agency, Washington,
DC. Office of Emergency and Remedial Response.
Available from the National Technical Information
Service, Springfield, VA 22161, as PB88-185798.
Price codes: A04 in paper copy, A01 in microfiche.
Report No. EOA/ROD/R03-87/038, September
1987. 43p, 4 fig, 8 tab.

Descriptors: *Superfund, *Waste dumps, *Maryland, *Cleanup operations, *Groundwater pollution, *Soil contamination, *Path of pollutants, Baltimore, Costs, Benzene, Toluene, Xylene, Aromatic compounds, Hydrocarbons, Polychlorinated biphenyls, Heavy metals, Drainage, Water pollution treatment.

The Kane and Lombard site is an 8.4-acre parcel of undeveloped land in Baltimore, MD. Dumping and burning of construction debris, domestic trash and drums occurred at the site from 1962 until 1967 drums occurred at the site from 1962 until 1967 when the city passed an ordinance prohibiting the open burning of refuse. Illegal dumping continued from 1967 until approximately 1984, during which time many citations were issued for illegal burning on the property. In 1980 Maryland State inspectors observed between 400 and 500 drums, the majority of which were rusted, damaged and contained holes. Following an onsite property assessment, EPA authorized the immediate removal of 1,163 EPA authorized the immediate removal of 1,163 drums in 1984. Of those, 822 drums were classified as empty and 341 drums contained contaminants which included: benzene, toluene, xylene, PAHs, PCBs and heavy metals. Approximately six inches of soil below the drums were removed and disposed offsite. The site was stabilized by regrading, capping and revegetation. Currently soil and groundwater are contaminated with these prior drum contaminants. The selected remedial action for this site includes: removal of drums hot spots. for this site includes: removal of drums, hot spots and contaminated soil (approximately 67,000 cu yd); site cleaning and removal of vegetation to facilitate the construction of subsurface containnacultate the construction of subsurface contain-ment/diversion structures; construction of a multi-layer soil cap; construction of drainage system; clearing of drainage ditch along east side of the site; development of necessary surface water runoff facilities; and groundwater monitoring. The estimated capital cost for this remedial action is \$4,692.660 with annual operation and maintenance of \$28.90 (Author's abstract) of \$28,930. (Author's abstract)

PILOT SCALE EVALUATION OF SLUDGE LANDFILLING: FOUR YEARS OF OPER-

ATION,
SCS Engineers, Inc., Covington, KY.
J. M. Stamm, and J. J. Walsh.
Available from the National Technical Information
Service, Springfield, VA 22161, as PB88-208434.
Price codes: A10 in paper copy, A01 in microfiche.
Report No. EPA/600/2-88/027, May 1988. 242p,
48 fig. 27 tab, 9 ref, 3 append. EPA Contract 6803-3220.

Descriptors: *Pilot plants, *Wastewater disposal, *Sludge disposal, *Landfills, *Path of pollutants, Lysimetry, Leachates, Biodegradation, Codisposal.

A sludge landfill simulator program consisting of 28 lysimeters was used to evaluate sludge landfilling as a disposal option by assessing the environmental impacts on leachate composition and gas production. The disposal scenarios investigated were codisposal, refuse-only, and sludge-only. Lysimeters were housed at EPAs Test and Evaluation Facility in Cincinnati, Ohio. Thirty-four parameters were measured to document leachate and gas quality and quantity. In addition, certain lysimeters were spiked with a priority pollutant solution to investigate the generation of potentially hazardous leachate. This study presents the results of four years of research, from July 1982 to June 1986. A complete tabulation of data collected over the four years is included in the report. Results indicate that years is included in the report. Results indicate that codisposal of sludge and refuse accelerated the anaerobic decomposition processes relative to the other disposal scenarios. Infiltration rate, sludge loading rate, and sludge type produced definitive effects on the leachate and gas quality and quantieffects on the leachate and gas quality and quantity. A review of leachate and gas quality data
suggests that the codisposal of sludge and refuse is
a superior means of disposal. Codisposal had the
least detrimental effect on leachate quality while
positively affecting the decomposition processes
(as measured by methane generation). Gas chromatography/mass spectrometry (GC/MS) analysis of
leachate samples showed several leaching trends
exhibited by the priority pollutants from both the
sludge-only and codisposal test cells. (Author's
abstract)

W89_02978

SIMULATION OF FLOOD HYDROGRAPHS FOR GEORGIA STREAMS, Geological Survey, Doraville, GA. Water Re-

F I Inman

Available from Books and Open File Report Section, USGS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4004, 1986. 41p, 15 fig. 13 tab, 13 ref.

Descriptors: *Flood hydrographs, *Georgia, *Flood peak, *Hydrographs, *Regression analysis, *Unit hydrographs, *Simulation, Rural areas, Urban areas, Atlanta, River basins, Stream dis-charge, Drainage area, Impervious areas.

The O'Donnell method was used to compute unit hydrographs and lagtimes for 355 floods at 80 gaging stations in Georgia. An average unit hydrograph and an average lagtime were computed for each station. These average unit hydrographs were each station. These average unit hydrographs were transformed to unit hydrographs having durations of one-fourth, one-third, one-half, and three-fourths lagtime, then reduced to dimensionless terms by dividing the time by lagtime and the discharge by peak discharge. Hydrographs were simulated for these 35 floods and their widths compared with the widths of the observed hydrographs at 50% and 75% of peak flow. The dimensionless hydrograph based on one-half lagtime duration provided the best fit of the observed data. Multiple-regression analysis was used to define reration provided the best fit of the observed data. Multiple-regression analysis was used to define relations between lagtime and certain physical basin characteristics. Drainage area and slope were significant for the rural stream equations and drainage area, slope, and impervious area were significant for the Atlanta urban-stream equation. A hydrograph can be simulated from the dimensionless hydrograph, the peak discharge of a specific recurrence interval, and the lastime obtained from reinyurograph, the peak discharge of a specific recurrence interval, and the lagtime obtained from regression equations for any site with a < 500 sq mi drainage area in Georgia. For simulating hydrographs at sites with basins > 500 sq mi, the USGS computer model CONROUT can be used. (Author's abstract) W89.01000 W89-03002

EFFECT OF ACTIVATED SLUDGE IN THE BREEDER DIET ON THE REPRODUCTION CRITERIA AND THE PERFORMANCE OF THEIR OFFSPRING,

Agricultural Research Organization, Bet-Dagan (Israel). Volcani Center.

B. Lipstein, M. Ben-Moshe, and O. Pinto. Nutrition Reports International NURIBL, Vol. 38, No. 2, p 381-386, August 1988, 4 tab, 12 ref.

Descriptors: *Activated sludge, *Sludge utiliza-tion, *Feeds, *Poultry diets, *Nutrition, Reproduc-tion, Animal growth.

The effect of the inclusion of activated sludge in diets of male and female chickens on their reproduction criteria and the growth of their offspring was assessed. The experiment was carried out on 192 hens and 10 cockerels fed either the control diet or a diet containing 100 cockerels. diet or a diet containing 20% activated sludge. The inseminations were performed in a factorial arrangement, with semen of cockerels fed on one of the two diets used to inseminate hens fed similarly on one of the two diets; thus four experimental treatments were obtained. Inclusion of 20% sludge treatments were obtained. Inclusion of 20% sludge in the cockerel diet had no adverse effect on sperm quality. The sludge in the layer diet had no adverse effect on fertility or hatchability. Body weight of 4-week-old offspring indicated that chicks from eggs in which both of the parents were fed the sludge diets were heavier than those of parents fed the control diet. Sludge in the layer diet had no adverse effect on production rate, egg weight or shell egg density. However, the feed intake and feed efficiency increased compared with the control diet. (Author's abstract) W89-03061

Group 5E-Ultimate Disposal Of Wastes

MICROBIAL ACTIVITY IN SANITARY LAND-FILLS: A POSSIBLE SOURCE OF THE HUMIC SUBSTANCES IN GROUNDWATER, Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene. For primary bibliographic entry see Field 5B. W89-03079

EFFECT OF UNSATURATED/SATURATED ZONE PROPERTY UPON THE HYDROGEO-CHEMICAL AND MICROBIOLOGICAL PROC-ESSES INVOLVED IN THE MIGRATION AND ATTENUATION OF LANDFILL LEACHATE

COMPONENTS,
Water Research Centre, Medmenham (England).
For primary bibliographic entry see Field 5B.
W89-03087

BELT FILTER PRESS DEWATERING OF WASTEWATER SLUDGE. American Society of Civil Engineers, New York. Task Committee on Belt Filter Presses. For primary bibliographic entry see Field 5D. W89-03099

LEACHATE COLLECTION IN LANDFILLS: STEADY CASE,
Kansas Univ., Lawrence. Dept. of Civil Engineer-

ing.

B. M. McEnroe, and P. R. Schroeder.

Journal of Environmental Engineering (ASCE)

JOEDDU, Vol. 114, No. 5, p 1052-1062, October

1988. 4 fig, 7 tab, append.

Descriptors: *Landfills, *Water pollution control, *Water pollution prevention, *Model studies, *Liners, *Leachates, Mathematical studies, Environmental engineering, Groundwater movement, Hydraulic conductivity, Path of pollutants, Soil

The performance of landfill leachate collection systems with low-permeability soil liners was analyzed under steady-state conditions. Algebraic equations and graphs are presented for predicting the average and maximum saturated depth on the liner, the location of the maximum saturated depth, and the leakage rate. These equations and graphs are developed from numerical solutions of the governing differential equation. Some surprisingly simple relationships are shown to be applicable sample relationships are shown to be applicable over much of the practical range. In general, saturated depth over the liner is sensitive to four parameters: the liner slope, the drainage length or drain spacing, the saturated hydraulic conductivity of the drain layer, and the difference between the impingement rate on the liner and the liner's hy-draulic conductivity. Under normal conditions, leakage rate is sensitive only to the hydraulic conductivity of the liner. Within the practical range, liner thickness has little effect on either saturated depth or leakage rate. (Author's abstract) W89-03102

OCEAN OUTFALL SYSTEM FOR DENSE AND BUOYANT EFFLUENTS,
Georgia Inst. of Tech., Atlanta. School of Civil

Engineering.
P. J. W. Roberts, and G. Toms.

JOURNAI Of Environmental Engineering (ASCE) JOEDDU, Vol. 114, No. 5, p 1175-1191, October 1988. 7 fig. 2 tab, 18 ref, append.

Descriptors: *Wastewater disposal, *Outfall, *Effluents, *Wastewater outfall, Municipal wastewater, Industrial wastewater, Ocean dumping, Fluoride, Design criteria.

The conceptual design of an existing ocean outfall system for disposal of municipal and industrial wastewaters is reported. The wastewaters are fertuilizer plant effluent, which contains large amounts of gypsum and fluoride, pulp-mill effluent, and municipal sewage. The effluents are separated into two streams of different characteristics and then discharged through two outfalls. One stream contains the expression and is negatively become in tains the gypsum and is negatively buoyant in seawater. This outfall was designed to minimize pumping power, while achieving sufficient dilutions to cause the gypsum to go into solution, thus minimizing deposition of gypsum on the seafloor. The other stream contains the remaining effluents plus the fluoride and is positively buoyant in sea-water. This outfall was designed to meet fluoride water. This outfall was designed to meet fluoride concentration requirements in the receiving water by maximizing dilution. Unique to this project was the interplay between the outfall design team and the contributing industries, which resulted in on-shore design changes to accomodate the separation of effluents and a more effective disposal system. (Author's abstract)

W89-03108

WASTEWATER IRRIGATION OF VEGETARIE

CROPS,
Purdue Univ., Lafayette, IN. Dept. of Horticul-

ture.
T. L. Davis, J. K. Greig, and M. B. Kirkham.
Biocycle BCYCDK, Vol. 29, No. 8, p 60-63, September 1988. 4 tab, 14 ref.

Descriptors: *Wastewater, *Irrigation, *Wastewater disposal, *Wastewater irrigation, orVegetable crops, Municipal wastewater, Heavy metals, Cadmium, Lead, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Cobalt, Manganese, Copper, Iron, Trace elements.

Research to determine the growth and elemental composition of vegetables irrigated with municipal sewage effluent is discussed. Twelve pots were labelled for each of three vegetables (radishes, mustard, and green beans) and divided equally into treatments. Treatment 1 (control) consisted of recommended NPK fertilization irrigated with tap water. Treatment 2 consisted of recommended NPK fertilization irrigated with secondary municipal sewage effluent. Treatment 3 consisted of neftilization irrigated with secondary municipal sewage effluent. Extractable concentrations of heavy metals (cadmium, conner iron manageness. sewage effluent. Extractable concentrations of heavy metals (cadmium, copper, iron, manganese, lead, zinc) in effluent-irrigated soil were not higher than those in soil with NPK fertilizer and irrigated with tap water. Effluent did not contribute to the salinity of the soil. Edible yields of radish, mustard and green bean irrigated with municipal effluent were similar to those of the three vegetables treatwere similar to inose of the three vegetables treat-ed with NPK fertilizer. In general, concentrations of nitrogen, phosphorus, potassium, calcium, mag-nesium, copper, cobalt, iron, manganese, and zinc in plants irrigated with effluent did not differ sigin paints irrigated with effluent did not differ sig-inficantly from concentrations in control plants. Concentrations of cadmium and lead were high in all plants, including the controls. Overall, second-ary municipal sewage effluent appeared to be a good source of nutrients and water for vegetable growth. (Miller-PTT) W89-03282

PROMISING TECHNOLOGIES FOR THE BIO-LOGICAL DETOXIFICATION OF HAZARD-OUS WASTE, Environmental Protection Agency, Cincinnati,

For primary bibliographic entry see Field 5D. W89-03322

5F. Water Treatment and Quality Alteration

OPTIMIZING OPERATION AND MAINTE-NANCE OF WATER SUPPLY WELLS, Weston (Roy F.), Inc., West Chester, PA. For primary bibliographic entry see Field 6B.

TECHNOLOGIES AND COSTS FOR THE TREATMENT OF MICROBIAL CONTAMINANTS IN POTABLE WATER SUPPLIES. Pirnie (Malcolm), Inc., Paramus, NJ. Available from the National Technical Information Service, Springfield, VA. 22161, as PB87-215380. Price codes A14 in paper copy, A01 in microfiche. April 1987, 320p, 19 fig., 79 tab, 198 ref, 3 append. EPA Contract 68-01-6989.

scriptors: *Water treatment, *Potable water, *Microorganisms, *Costs, Drinking water, Coliforms, Coagulation, Flocculation, Sedimentation, Filtration, Disinfection, Turbidity, Giardia, Bacteria. Virus

Water treatment technologies and associated cost for removing turbidity, Giardia, viruses and bacteria from public drinking water supplies discussed to comply with the EPA's proposed surface water treatment requirements plus the total coliform maximum contaminants levels (MCLs). Technologies discussed include conventional treatment (coagulation, flocculation, sedimentation, and fil-tration), direct filtration, diatomaceous earth filtration, slow-sand filtration, and package plants. Dis-infection methods discussed include chlorine, chlorine dioxide, chloramines and ozone. Alternative filtration and disinfection technologies are also discussed. (Author's abstract) W89-02412

WATER SYSTEM RESPONSES TO TOXIC CONTAMINATION OF GROUNDWATER SUP-

Wisconsin Univ.-Milwaukee. Dept. of Urban Planning.

G. W. Page.

Available from the National Technical Information Avanable from the National Technical Information Services, Springfield, VA 22161 as PB88-223524/ AS. Price codes: A03 in paper copy; A01 in micro-fiche. Wisconsin Water Resources Center, Madi-son, Technical Report WIS WRD 88-01, 1988. 26p, 9 tab, 54 ref.

Descriptors: *Organic compounds, *Air-stripping towers, Water treatment, *Drinking water, *Groundwater pollution, Water treatment, Groundwater, Potable water, Utilities, Water supply, Municipal water supply, Wisconsin.

Contamination of groundwater supplies with vola Contamination of groundwater supplies with volatile organic compounds is a recently discovered and significant problem. Municipalities and their community water systems are often the first to identify groundwater contamination because of the monitoring programs they are required to carry out. When contamination exceeds standards, some action to correct the problem is required. The responses of Wisconsin municipalities to volatile organic compounds (VOC) exceeding standards in their groundwater sources are described. Actions to protect human health are prompt, but the survey results indicate that plumes of contaminated groundwater are usually not treated. They may continue to migrate and contaminate other private and public wells. In a case study, the costs of and public wells. In a case study, the costs of responding to VOC contamination in Hartland, responding to VOC contamination in Hartland, Wisconsin, have not resulted in a major financial burden on the customers. Counter-current packed-column air stripping towers (AST) are a cost-effective technology to remove VOCs. With a population of 3,559, the additional cost of water treatment in Hartland was spread over a sufficient number of people that neither the total additional cost nor the percentage increase in the cost of water was excessive. Pesticides, herbicides, heavy water was excessive. Festicles, herocides, near metals or other classes of toxic contaminants are probably not effectively removed using an AST. Some municipalities are using air-stripping and GAC filtration. Costs, comparable to the \$30,000 per year for capital amortization in Hartland to-gether with operation and maintenance, could be a great burden on small rural communities. (USGS) W39-02586

USE OF RAPID SMALL-SCALE COLUMN TESTS TO PREDICT FULL-SCALE ADSORPTION CAPACITY AND PERFORMANCE,

Michigan Technological Univ., Houghton. D. W. Hineline, J. C. Crittenden, and D. W. Hand. D. W. Haneline, J. C. Crittenden, and D. W. Hanel. Available from the National Technical Information Service, Springfield, VA. 22161, as PB87-208369. Price codes: A02 in paper copy, A01 in microfiche. Report No. EPA/600/D-87/218, July 1987. 209. fig, 3 tab, 19 ref. EPA Contract CR-811109-01-0.

Descriptors: *Water treatment, *Adsorption, *Organic compounds, *Pilot plants, Chemical treatment, Drinking water, Organic carbon.

Water Treatment and Quality Alteration—Group 5F

Concern over the long term health effects of trace quantities of synthetic organic chemicals found in many U.S. community drinking water sources has prompted an intense research effort to find ecoprompted an intense research effort to find economical and effective removal processes. A rapid-method for the design of full-scale fixed bed adsorbers from small-column studies, known as the small-scale column test (RSSCT) has been developed. The scope of this study was to design and conduct a RSSCT at the pilot plant well site in Suffolk County, NY, to stimulate a long period of pilot plant operation. The RSSCT continues to be a promising technique for determining full-scale adsorber performance. Much more work is needed, however, to examine the effect of (TOC) toxic organic chemical preloading on the RSSCT process. The rate studies conducted in this work did not use carbon preloaded with TOCs. Rate studies need to be conducted on preloaded carbon to not use carbon preloaded with TOCs. Rate studies need to be conducted on preloaded carbon to determine the effect of pre-adsorption on the relationship between surface diffusion coefficient and adsorbent size. Also, more field comparison of the RSSCT with existing full scale plants is needed to establish its ability to predict full-scale performance. (Lantz-PTT) W89-02789

EXPERIENCES WITH GRANULAR ACTIVAT-ED CARBON FILTRATION AND ON-SITE RE-ACTIVATION AT JEFFERSON PARISH, LOU-

ACTIVATION AT JEFFERSON FARMER, ESCALARY STATES AND ACTIVATION AT JEFFERSON FARMER, LA. W. J. Koffskey, and B. W. Lykins.

Available from the National Technical Information Service, Springfield, VA. 22161, as PB87-206199. Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA/600/D-87/217, July 1987. 27p, 11 fig, 8 tab, 5 ref. EPA Contract CS806925.

Descriptors: *Activated carbon, *Granular activated carbon, *Filtration, *Water treatment, *Reactivation, *Louisiana, Jefferson Parish, Organic compounds, Economic aspects, Drinking water, Chemical treatment.

Under a jointly funded cooperative agreement with U.S. EPA, three 1-mgd granular activated carbon (GAC) adsorbers and a reactivation pilot facility were constructed at Jefferson Parish, LA. facility were constructed and a reactivation pilot facility were constructed at Jefferson Parish, LA. The project objectives were to assess the economic impact of removing trace organic contaminants from lower Mississippi River drinking water and to evaluate the utility of the infrared reactivation furnace for repeated reactivation of GAC. While on-site reactivation was not free of problems, reactivated GAC was essentially equivalent to virgin GAC, the volumetric GAC transport and reactivation loss was 9%, and, while low levels of some reactivation by-products were observed, the maximinmal at 3 in 1 billion. Approximately \$2.2 million (1983 dollars) was required for design and construction of the facility. The O&M cost for the facility was about 14 cents/1,000 gal for a 20 min. empty bed connect time and a 3-month GAC reactivation cycle. (Author's abstract)

PRETREATMENT IN CHEMICAL WATER AND WASTEWATER TREATMENT. For primary bibliographic entry see Field 5G. W89-02791

FROM FILTERS TO FORESTS: WATER TREATMENT AND SUPPLY,

JANEA JAMENT AND SUPPLY,
Johns Hopkins Univ., Baltimore, MD.
C. R. O'Melia.
IN: Pretreatment in Chemical Water and
Wastewater Treatment. Springer-Verlag, New
York. 1988. p 3-14, 10 ref.

Descriptors: *Pretreatment of water, *Water treatment, *Water supply, *Water quality, *Water treatment facilities, Catchment areas, Phosphorus, Dissolved solids, Particle size, Filtration, Coagulation, Flocculation, Sedimentation basins, Design

Physical, chemical, and biological processes in the atmospheric, terrestrial, and aquatic environments

establish the major characteristics of water supplies and affect the concentrations of pollutants in these supplies. In this paper the direction is 'upstream', beginning with packed-bed filters and moving backward through a conventional water-treatment plant by considering, in turn, sedimentation basins, flocculation facilities, rapid-mixing tanks with coagulant additions, surface water supplies such as lakes and reservoirs, and ending in the drainage area tributary to the supply. The chemical composition of a fresh water depends on the nature and the use of its tributary drainage area. The paper focuses on phosphorus, humic substances, and hardness. Particle production in aquatic systems depends upon phosphorus inputs. The coagulant requirements in a water-treatment plant are normally established by the dissolved organic compounds in the water. Flocculation facilities alter particle sizes and particle-size distributions. The pounds in the water. Flocculation facilities alter particle sizes and particle-size distributions. The filter media operative during most of a filtration run are the particles that have been removed by the filter. These originate on the land, in the lake, and are produced by coagulants. The design and operation of water-treatment facilities should reflect characteristics of the water source. (See also W89-02791) (Shidler-PTT)

PRETREATMENT OF DRINKING WATER TO CONTROL ORGANIC CONTAMINANTS AND TASTE AND ODOR, Drexel Univ., Philadelphia, PA. Environmental

Studies Inst.

I. H. Suffet, R. J. Baker, and T. L. Yohe.

IN: Pretreatment in Chemical Water and
Wastewater Treatment. Springer-Verlag, New
York. 1988. p 15-39, 5 fig. 11 tab, 50 ref.

Descriptors: *Water treatment, *Pretreatment of water, *Drinking water, *Organic compounds, *Taste, *Odor control, Literature review, Oxidation, Aeration, Biodegradation, Activated carbon, Water treatment facilities, Philadelphia, Hazardous materials.

A laboratory study and related literature on pre-treatment of drinking water for removal of organic contaminants and taste and odor are evaluated. Pretreatment may include oxidation, aeration, bio-Pretreatment may include oxidation, aeration, biodegradation, or powdered activated carbon (PAC). The unit processes described are those used by the majority of water-treatment plants in the United States, represented by the Philadelphia Suburban Water Company's Neshaminy Plant. In a recent laboratory study, Neshaminy Creek water was spiked with a mixture of 15 low-molecular-weight, potentially organoleptic, or hazardous compounds at low-ppb concentrations. The solution was treated with oxidants or PAC; residuals of the test compounds were quantified and percent removal for each compound/treatment combination were calculated. Laboratory results and the literature indicate that oxidants are ineffective for removing most low-molecular-weight organic compounds. indicate that oxidants are ineffective for removing most low-molecular-weight organic compounds, although exceptions have been reported. All test compounds were removed to some degree by PAC, eight by greater than 90%. Aeration is effective for removing small volatile compounds. (See also W89-02791) (Author's abstract) W89-02793

WATER QUALITY PROBLEMS AND CONTROL STRATEGIES FOR THE WATER SUPPLY OF TIANJIN CITY,
Tianjin Inst. of Environmental Protection and Sci-

ences (China).

ences (China).
X. Zhu.
IN: Pretreatment in Chemical Water and
Wastewater Treatment. Springer-Verlag, New
York. 1988. p 41-53, 5 fig, 1 tab, 4 ref.

Descriptors: *Water quality control, *Pretreatment of water, *Water supply, *Water quality manage-ment, *China, Eutrophication, *Water treatment, Management planning, Cost-benefit analysis, Luan River, Tianjin.

The diversion of water from the Luan River into Tianjin is a vast urban water-supply project. There are some obvious and potential pollution hazards for the drinking water supply; eutrophication, es-

pecially, is a serious problem and leads to difficul-ties at the water-treatment plant. This paper at-tempts to provide information on this issue and to these at the water-treatment plant. This paper attempts to provide information on this issue and to discuss the program of water-quality conservation and management for the water supply of Tianjin based on various treatment techniques used in the basin, the reservoir, and the water-treatment plant. The basic approach for achieving these objectives consists of identification of water-quality problems and establishment of management goals, assessment of information available on the watershed, identification of options for management of water quality, analysis of costs and expected benefits of alternative management and control options, evaluation of the adequacy of the existing institutional and regulatory framework for implementing alternative management strategies, selection of desired control strategies, and periodic submission of progress reports on the control program to the government. (See also W89-02791) (Shidler-PTT) W89-02794

HUMIC SUBSTANCES REMOVAL BY ALUM COAGULATION: DIRECT FILTRATION AT

J. Fettig, H. Odegaard, and B. Eikebrokk. IN: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 55-66, 9 fig, 2 tab, 31 ref.

Descriptors: *Water treatment, *Dissolved solids, *Alum, *Coagulation, *Pretreatment of water, *Filtration, Hydrogen ion concentration, Chemical treatment, Sedimentation, Sand filters, Kinetics.

The potential for using alum for the coagulation of humic substances was evaluated by treating a colored surface water. Jar testing revealed that only one major removal domain existed, with an optimum pH value being 5.5. Sedimentation and filtration behavior of the flocs were studied between pH = 4.7 and pH = 7. Sand filters of different bed lengths were used. Filtration efficiency was best for pH < 5. From the point of view of floc separation by direct filtration, therefore, conducting the process at pH < 5 offers advantages. However, the kinetics of floc formation depended on pH, that is, they were much slower at pH = 4 compared to pH = 6. Sedimentation worked best at pH = 6. The results show good agreement with data from preliminary technical-scale experiments conducted with the same raw water. (See also W89-02791) (Author's abstract) W89-02795

MODELING THE EFFECTS OF ADSORBED HYDROLYZED ALUID-IONS ON DEEP BED FILTRATION,

Tsinghua Univ., Beijing (China). Dept. of Environmental Engineering.

In: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 67-90, 11 fig, 3 tab, 64 ref.

Descriptors: *Water treatment, *Filtration, *Deep-bed filtration, *Aduminum, *Adsorption, *Model studies, Model testing, Hydrolysis, Suspended solids, Chemical precipitation, Ions, Hydrogen ion

A model for determining the effects of hydrolyzed aluminum ions on filtration of dilute suspensions by deep bed filters was developed and experimentally tested at laboratory scale. The model relates solution conditions, especially pH and concentrations of Al(III), to the performance of clean filter beds. A surface-precipitation model was used to describe surface properties of the suspended particles in terms of solution chemistry. This chemical model was combined with flow models and particle-capture formulations within the filter bed to predict the filter performance. The complete model was tested with experiments using suspensions of polystyrene latex particles with a diameter of 0.2 microns applied to filter media comprised of glass beads with a diameter of 0.4 mm. In the presence of Al(III), a favorable filtration region appeared in the middle of the pH range due to charge reversal of the particles. The width of the favorable pH

Group 5F-Water Treatment and Quality Alteration

region depended upon the concentrations of Al(III) and particle surface area. The present model can qualitatively explain this observation. (See also W89-02791) (Author's abstract)

POLYELECTROLYTES FOR THE TREAT-MENT OF TAP AND FILTER BACK WASHING

WATER, Chemische Fabrik Stockhausen G.m.b.H., Krefeld

Chemische Fabrik Stockhausen G. H., Raden (German), F.R.). J. M. Reuter, and A. Landscheidt. IN: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 91-101, 8 fig, 2 tab. Water and

Descriptors: *Water treatment, *Polyelectrolytes, *Potable water, *Pretreatment of water, Costs, *Filter-backwashing water, Flocculation, Kinetics, Economic aspects.

Polymeric organic flocculants have been used in water-treatment and in sludge-dewatering processes now for more than 30 years; they have also been introduced in the treatment of potable water. The purpose of this report is to give a short description of the structure and kinetics of the flocculants used in potable-water treatment, to describe the optimal application parameters and to describe some special effects concerning, e.g., the possibilities for reducing the dosage of primary coagulation aids or removing algae from the water. The cost of the polymers will mostly be recovered by reduced costs for primary coagulation chemicals, reduced backwashing cycles, increased capacity without adding mechanical equipment like sedimentation tanks or enlarging filter area, and, finally, by an improved water quality. (See also W89-02791) (Shidler-PTT)

NEW COAGULANT INJECTION PROCESS,

NEW COAGULANT INJECTION PROCESS, Compagnie Generale des Eaux, Paris (France). C. Ventresque, and G. Bablon. IN: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 103-112, 12 fig, 1 tab, 2 ref.

Descriptors: *Water treatment, *Coagulation, *Coagulant injection, Water treatment facilities, Chemical treatment, Aluminum polychloride, Filtration, Suspended solids, France, Costs.

Among the processes used in the treatment of potable water, one of the trickiest to handle is the addition of the coagulant. At Neuilly-sur-Marne, a new coagulant-injection system has been installed in a plant producing 800,000 cubic m of water per day. Presently the coagulant used is aluminum polychloride and, if necessary, ferrous sulfate, sodium hydroxide, carbon dioxide, and powdered sodium nydroxide, carbon dixide, and powdered activated carbon (which absorbs micro-pollutants) are added. The coagulant feed installed in the plant includes three independent trains connected to a gravity circuit; the reagent-flow rate is adjusted by low-pressure regulating valves. It has been proven that the conditions in which the coagulant is mixed that the conditions in which the coagulant is mixed with the water to be treated constitute an impor-tant factor in determining the efficiency of separa-tion treatments located downstream, and this is applicable down to the level of the filters. If the volume of water to be treated daily is very large, volume of water to be treated daily is very large, mixing systems using agitators are not very effective. The injection system can be adapted to large-scale units by using a dilution of the coagulant, which allows treatment to be ensured in large-diameter pipes. Moreover, the system presented here has a distinctive feature in that the reagent circulates by gravity flow without having to be put under pressure. The filters provide better removal of the suspended solids and aluminum, filtration runs are longer and so allow considerable saving on filter washing. (See also W89-02791) (Shidler-PTT) PTT) W89-02798

ODOUR CONTROL BY ARTIFICIAL GROUNDWATER RECHARGE, Linkoeping Univ. (Sweden). Dept. of Water in Environment and Society.

R. Savenhed, B. V. Lundgren, H. Boren, and A.

Grimvall.

IN: Pretreatment in Chemical Water and Wastewater Treatment. Springer-Verlag, New York. 1988. p 113-122, 4 fig, 1 tab, 28 ref.

Descriptors: *Water treatment, *Groundwater re-charge, *Artificial recharge, *Odor control, Or-ganic compounds, Induced infiltration, Biological filters, Sand filters, Sweden, Performance evalua-

The removal of odorous compounds during artificial groundwater recharge in sand and gravel ridges (eskers) was evaluated by gas chromatography with both instrumental and sensory detection ('chromatographic sniffing'). Seven Swedish waterworks were included in the study. It was shown terworks were included in the study. It was shown that the off-odor compounds in the raw water samples (geosmin, 2-methylisoborneol, 2-isopropyl-3-methoxypyrazine, 2.4,6-trichloroanisole, 1-octen-3-one, dimethyl trisulfide, and a number of unidentified muddy or musty odors) were all effectively removed during infiltration, thus proving that artificial groundwater recharge is not only a suitable method for water storage but can also be an effective method for removing odorous compounds. Laboratory experiments with filtration of raw water through biologically-active sand filters showed that a good oxygen supply is the key to water through biologically-active sand filters showed that a good oxygen supply is the key to both effective removal of naturally-occurring off-odor compounds and to prolonged running times for the filters. Comparisons were made to alum coagulation/sand filtration and it was concluded coaguiation/saint intration and it was concluded that biological treatment methods often are superi-or to physical/chemical methods for effective odor control. (See also W89-02791) (Author's abstract) W89-02799

PESTICIDE AND SYNTHETIC ORGANIC COMPOUND SURVEY: REPORT TO THE IOWA GENERAL ASSEMBLY ON THE RESULTS OF THE WATER SYSTEM MONITORING REQUIRED BY HOUSE FILE 2303.

Iowa Dept. of Natural Resources, Des Moines. Environmental Protection Div. Environmental Protection Div. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-210513. Price codes: A06 in paper copy, A01 in microfiche. March 1988. 98p, 2 fig, 6 tab, 4 append.

Descriptors: *Water treatment, *Water treatment facilities, *Iowa, *Monitoring, *Water quality control, *Pesticides, Organic compounds, Trihalomethane, Atrazine, Surface waters, Groundwater pollution, Groundwater quality, Synthetic organic

In 1986 the Seventy-first Iowa General Assembly passed House File 2303. This legislation required the Iowa Department of Natural Resources (IDNR) to develop and implement a one-time, finished water testing program of public and privately owned water systems for pesticides and synthetic organic contaminants (SOC). Eight hundred and fifty-three public water systems were tested; 122 tested positive for one or more pesticides, 548 tested positive for one or more synthetic organic compounds. No measurable concentrations cides, 348 tested positive tor one of more synthetic organic compounds. No measurable concentrations of pesticides or synthetic organic chemicals were found in 279 systems. Nine water systems had pesticides or synthetic organic chemical levels that exceeded EPA Health Advisory Levels or federal maximum contaminant levels. Contaminant levels high enough to cause an acute health risk were not observed. The pesticides most commonly found were Atraine, Bladex, Lasso, Dual and 2,4-D. The most frequently found synthetic organic chemicals belong to a group of compounds called trihalomethanes (THMs). THMs are formed during disinfection when chlorine reacts with organic matter in the water. The most significant findings drawn from the project are: (1) surface water systems have the greatest potential for pesticide contamination; (2) the shallower groundwater sources have a greater potential for contamination by pesticides and SOC's; (3) a seasonal trend in pesticide occurrences in water sources was not observed; and (4) the frequency of appearance and concentration of trihalomethanes in groundwater systems was unexpected. (Lantz-PTT) W89-02836 high enough to cause an acute health risk were not

USING DESALINATION TECHNOLOGIES FOR WATER TREATMENT.

Office of Technology Assessment, Washington, For primary bibliographic entry see Field 3A. W89-02849

SELECTION GUIDE FOR VOLATILIZATION TECHNOLOGIES FOR WATER TREATMENT. IT Corp., Knoxville, TN.

J. L. Fleming.
Available from the National Technical Information
Service, Springfield, VA. 22161, as PB88-165683.
Price codes: A06 in paper copy, A01 in microfiche.
Report No. EPA/600/2-88/014, February 1988.
118p, 37 fig, 16 tab, 22 ref, 3 append. EPA Contract 68-03-3069.

Descriptors: *Volatile organic compounds, *Water treatment, *Wastewater treatment, *Volatilization, treatment, *Wastewater treatment, *Volatilization, Aeration, Sprayers, Costs, Economic aspects, Water treatment facilities, Standards, Mathemati-

This guide presents a methodology for evaluating applicability of volatilization technologies for removing volatile organics from water. The technologies assessed include: surface sprayers, surface aerators, bubble columns, cooling towers, steam strippers, unaided evaporation from an impoundment, spray columns, and packed air stripping columns. The guide enables users to assess performing umns. The guide enables users to assess performance and cost under a variety of operating conditions (e.g., temperature, influent concentration, and flow rates) for representative equipment designs that could be transported on a trailer 2.4 m wide, 13.7 m long, with a maximum height of 4.1 m. The 13.7 m long, with a maximum height of 4.1 m. The designs are used as a basis to calculate representative contaminant removal efficiency, treatment rates, air emissions, and treatment costs of each technology. A key parameter used in assessing these technologies is the Henry's Law constant (H). A tabulation of available values of H is provided for volatiles designated as hazardous by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Methods for estimating H are also described. Qualitative guidance is provided on other factors that should be considered during site-specific assessments of the technical and economic feasibility of volatilization technologies. Offgas treatment is not described. An example problem is solved to demonstrate the methodology. (Author's abstract) W89-02863 W89-02863

TREATMENT OF ROME RAW WATER BY KROFTA SANDFLOAT PROCESS SYSTEM -- PROJECT DOCUMENTATION (PART A),

PROJECT DOCUMENTATION (PART A),
Krofta Engineering Corp., Lenox, MA.
M. Krofta, and L. K. Wang.
Available from the National Technical Information
Service, Springfield, VA 22161, as PB88-200670.
Price codes: A10 in paper copy, A01 in microfiche.
Technical Report No. KEC/01-84/4B1, February
29, 1984. 238p. State of New York Project
R83P06.

Descriptors: *Water treatment, *Sandfloat process, *Water supply, *Water quality, *Chemical treatment, Flocculation, Chlorination, Filtration, New York, Stokes Reservoir, Water quality control, Hydrogen ion concentration, Turbidity, Color, Coliforms, Trihalomethane, Drinking water, Organic compounds.

A Sandfloat system consisting of chemical flocculation, dissolved air flotation, sand filtration and post-chlorination was successfully operated to treat raw water from Stokes Reservoir in Oneida County, New York. The plant effluent always met the New York State Water Quality Goals and the U.S. EPA Drinking Water Standards for pH, color, turbidity, coliform, and trihalomethane. This volume which consists of the first appendix to the full report documents: the daily, weekly, and monthly operational data; chemical treatment data; particulate removal data; and water quality data of the plant effluent. (See also W89-02942 thru W89-02943) (Lantz-PTT)

Water Treatment and Quality Alteration—Group 5F

W89-02941

TREATMENT OF ROME RAW WATER BY KROFTA SANDFLOAT PROCESS SYSTEM - PROJECT DOCUMENTATION (PART B),

PROJECT DOCUMENTATION (PART B), Krofta Engineering Corp., Lenox, MA. M. Krofta, and L. K. Wang. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-200688. Price codes: A06 in paper copy, A01 in microfiche. Technical Report No. KKEC/01-84/4B2, Febru-ary 29, 1984. 136p. State of New York Project R83P06.

Descriptors: *Water treatment, *Sandfloat process, *Water supply, Flocculation, Chemical treatment, Chlorination, Filtration, New York, Stokes Reservoir, Water quality control, Hydrogen ion concentration, Turbdity, Color, Coliforms, Trihalomethane, Organic compounds.

A Sandfloat system consisting of chemical flocculation, dissolved air flotation, sand filtration and post-chlorination was successfully operated to treat raw water from Stokes Reservoir in Oneida County, New York. The plant effluent always met the New York State Water Quality Goals and the U.S. EPA Drinking Water Standards for pH, color, turbidity, coliform, and trihalomethane. This volume which consists of the Appendices B through I documents: the reduction of trihalomethand formation potential by the monitoring by NY certified water quality laboratories; chemical treatment data; removal data on records; sludge generation and characteristics; important analytical proment data; removal data on records; studge genera-tion and characteristics; important analytical pro-cedures; plant operational procedures; and impor-tant correspondence and communications. (See also W89-02942 thru W89-02943) (Lantz-PTT) W89-02942

TREATMENT OF ROME RAW WATER BY KROFTA SANDFLOAT PROCESS SYSTEM — PROJECT DOCUMENTATION (PART C), Krofta Engineering Corp., Lenox, MA. M. Krofta, and L. K. Wang. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-200696. Price codes: A06 in paper copy, A01 in microfiche. Technical Report No. KEC/03-84/1, March 16, 1984. 145p, 5 ref, 8 append. State of New York Project R83P06.

Descriptors: *Water treatment, *Sandfloat process *Water supply, *Alum, Flocculation, *Chemical treatment, *Filtration, New York, Stokes Resertreatment, "Futration, New York, Stokes Reservoir, Water quality control, Hydrogen ion concentration, Turbidity, Color removal, Coliforms, Trihalomethanes, Chlorination, Organic compounds, Sodium aluminate, Polymers.

A Sandfloat system consisting of chemical flocculation, dissolved air flotation, sand filtration and post-chlorination was successfully operated to treat raw water from Stokes Reservoir in Oneida County, New York. The plant effluent always met the New York State Water Quality Goals and the U.S. EPA Drinking Water Standards for pH, color, turbidity, coliform, and trihalomethane. The following data are given for the research period January 11 - March 5, 1984: the daily, weekly, and monthly operational data: chemical treatment data: monthly operational data; chemical treatment data; removal data on total trihalomethane formation potential; Giardia Cyst-sized particles; turbidity; color, down time records, sludge flow, etc. Alum, sodium aluminate and anionic polymer are con-cluded to be feasible for flotation treatment of highly colored Rome raw water. (See W89-02941 thru W89-02942) (Author's abstract) W89-02943

TREATMENT OF FARNHAM AND ASHLEY RESERVOIR WATER BY KROFTA SAND-FLOAT PROCESS SYSTEM -- PROJECT DOC-

FILOAT PROCESS SYSTEM - PROJECT DOC-UMENTATION, Krofta Engineering Corp., Lenox, MA. M. Krofta, and L. K. Wang. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-200654. Price codes: A06 in paper copy, A01 in microfich. Technical Report No. KEC/01-84/1B, January 24,

1984. City of Pittsfield Project No. R82P01.

Descriptors: *Water treatment, *Farnham Reser-Descriptors: "Water treatment, "Farnham Reservoir, "Ashley Reservoir," Floatation, "Sand filters, "Sandfloat, "Floccuation, Chemical treatment, Chlorination, Drinking water, Water quality, Hydrogen ion concentration, Color, Turbidity, Iron, Manganese, Coliforms, Trihalomethane.

A Sandfloat system consisting of chemical flocculation, dissolved air flotation, sand filtration and post-chlorination was successfully operated to treat raw water from Farnham and Ashley Reservoirs in Berkshire County, Massachusetts. The plant effluent always met the U.S. EPA and Massachusetts Drinking Water standards for pH, color; turbidity, iron, manganese, coliform, and trihalomethane color; down time records; sludge generation and characteristics; important analytical procedures; plant operational procedures; and important correspondence and communications. (See also W89-02951) (Author's abstract)

TREATMENT OF FARNHAM AND ASHLEY RESERVOIR WATER BY KROFTA SAND-FLOAT PROCESS SYSTEM -- FINAL PROJECT REPORT,

PROJECT REPORT,
Krofta Engineering Corp., Lenox, MA.
M. Krofta, and L. K. Wang.
Available from the National Technical Information
Service, Springfield, VA 22161, as PB88-200639.
Price codes: A06 in paper copy, A01 in microfiche.
Technical Report No. KEC/01-84/1, February 1,
1984. City of Pittsfield Project No. R82P01. 180p,
3 fig, 11 tab, 7 ref, 3 append.

Descriptors: *Water treatment, *Farnham Reservoir, *Ashley Reservoir, *Flotation, *Sand filters, *Massachusetts, *Sandfloat process, Chemical treatment, Flocculation, Chlorination, Drinking water, Water quality, Hydrogen ion concentration, Color, Turbidity, Iron, Manganese, Design criteria, Coliforms, Trihalomethane.

Raw water from Ashley and Farnham Reservoirs in Berkshire County, Massachusetts was treated by a newly developed Sandfloat process system con-sisting of chemical flocculation, dissolved air flota-tion and sand filtration. Turbidity, color, trihalo-methane formation potential, UV absorbance, colimethane formation potential, UV absorbance, coli-form bacteria, iron, manganese, lead and Giardia cyst-sized particles were significantly removed from the City of Pittsfield's raw water supply. The Sandfloat process easily met all the U.S. EPA and the Massachusetts Drinking Water Standards. Pre-liminary design criteria for coagulant feeding, chlorine feeding, flocculation detention time, flota-tion detention time, flotation surface loading, filter surface loading and sludge treatment are also de-veloped for design of a full scale potable flotation-filtration plant. (See also W89-02950) (Author's abstract) abstract) W89-02951

CONTROL OF VOLATILE ORGANIC CONTAMINANTS IN GROUNDWATER BY INWELL AERATION,

WELL AERATION,
North Penn Water Authority, Lansdale, PA.
J. A. Coyle, H. J. Borchers, and R. J. Miltner.
Available from the National Technical Information
Service, Springfield, VA 22161, as PB88-180112.
Price codes: A06 in paper copy, A01 in microfiche.
Report No. EPA/600/2-88/020, March 1988.
109p, 40 fig. 18 tab, 39 ref, 2 append. EPA Contract CR-809758.

Descriptors: *Water pollution control, *Volatile organic compounds, *Groundwater pollution, *Aeration, *Water treatment, *Wells, Trichloroethylene, Cleanup operations, Costs, Pumps, Aerations, Costs, Pumps, Aerations, Costs, Pumps, Aerations, Costs, Pumps, Aeratic Cleanup operations, Costs, Cost

Water was withdrawn from a 0.1 mgd well conwater was witnerswn from a 0.1 mgg weil con-taminated with several volatile organic compounds (VOCs), principally trichloroethyelene (TCE) for evaluation of treatment mehtods for emergency production of potable water. Several in-well aeration schemes were evaluated. The well was logged by the USGS to define possible zones of VOC entry. A straddle packer and pump apparatus

were utilized to isolate those zones and define their yield and level of VOC concentration. The technical literature together with this knowledge of the well were used to design an air lift pump. Operation of the air lift pump confirmed literature prediction of its low wire-to-water efficiency. Removal of TCE did not exceed 65%. Mass transfer occurred in the pump's eductor. Air lift pumping coupled with in-well diffused aeration increased TCE removal to 78%. When in-well diffused aeration was used with an electric submersible pump, TCE removal averaged 83%. In these last two schemes, mass transfer occurred utilizing the well as a countercurrent stripper. These technologies are limited by the volume of air that can be transferred to the well (air-to-water ratios below 12:1) and the cost of compressing air under high head. Thus, these technologies are not cost-effective compared to packed tower aeration. They are, however, quickly put on-line, easy to operate, and can serve as good short-term remedies while above-ground technologies are under design and construction. (Author's abstract) W89-02955

GASTROINTESTINAL ABSORPTION OF SOLUBLE URANIUM FROM DRINKING

Utah Univ., Salt Lake City. School of Medicine. For primary bibliographic entry see Field 5B. W89-02957

EVALUATION OF SODIUM ALUMINATE AS A COAGULANT FOR COST SAVINGS AT WATER TREATMENT PLANTS,

South Central Connecticut Regional Water Au-thority, New Haven.

thority, New Haven.

G. M. Huntley, L. K. Wang, and W. Layer.

Available from the National Technical Information
Service, Springfield, VA 22161, as PB88-168075.

Price codes: A03 in paper copy, A01 in microfiche.
Technical Paper No. LIR/05-85/148, May 21,
1985. 22p, 3 fig, 2 tab, 2 append.

Descriptors: *Water treatment, *Sodium aluminate, *Costs, *Coagulation, Alum, Economic aspects, Color, Water supply.

pects, Color, Water supply.

The feasibility of using liquid sodium aluminate (SA) in a more cost effective way for maintaining or improving the finished water quality at water treatment plants was studied. Evaluation of all tests performed, together with calculations of theoretical and actual values provide indications that SA will perform well and provide substantial advantages over present treatment. By adding approximately 24 mg/L of alum and discontinuing the feeding of caustic soda the following occurred: (1) 70% decrease in the actual amount of sodium added to the water while maintaining necessary levels of pH; (2) reduction in chemical treatment cost of \$27,000/yr for an average 6 MGD plant, also providing the same process performance during clarification and filtration; (3) reduced generation of sludge from the water treatment plant; and (4) water quality continued to be as is now attained, with the possible exception of color, which may increase slightly. SA is being successfully used in both conventional coagulation-sedimentation plants and in an innovative coagulation-flotation plant. (Author's abstract) W89-02959 W89-02959

NEW DISINFECTION AGENTS FOR WATER,

Auburn Univ., AL.
S. D. Worley, L. J. Swango, D. E. Williams, and
S. B. Barnela.

Available from the National Technical Information Service, Springfield, VA 22161, as AD-A188 693. Price codes: A04 in paper copy, A01 in microfiche. Annual/Final Report, September 1987. 75p, 20 fig, 18 tab, 38 ref. Army Contract DAMD17-82-C-2557.

Descriptors: *Water treatment, *Disinfection, *Chemical treatment, Water quality control, Bacteria, Organic compounds, Viruses, Halamines, Chlorine, Protozoa.

Group 5F-Water Treatment and Quality Alteration

Five new N-halamine compounds in the classes of oxaolidinones and imidazolidinones have been synoxaolidinones and imidazolidinones have been synthesized and tested as possible replacements for HTH (calcium hypochlorite) as military field water disinfectants. The primary attribute of all of the new compounds is great stability in water or in dry storage at a wide range of temperatures. The compounds are considerably less corrosive and less reactive with organic load than is free chlorine. reactive with organic load than is free chlorine. The compounds are particularly effective against protozoa such as Giardia lamblia and Entamoeba invadens; they are adequate bactericides (tested against Staphylococcus aureus, Shigella boydii, Pseudomonas aeruginosa, and Legionella pneumophila). With the exception of one of the compounds (1-bromo-3-chloro-4,4,5,5-tetramethyl-1phila). With the exception of one of the com-pounds (1-bromo-3-chloro-4,4,5)-tetramethyl-1-imidazolidinone, ABC) the new N-halamines are poor virucides. Compound ABC, however, is com-petitive with free chlorine as a virucide for rota-virus. Compound ABC is unique in that it provides rapid initial disinfection from its labile bromine moiety and stable, long-term disinfection from its chlorine moiety. It would appear to be the best new compound for military water disinfection de-veloped in this investigation. Mixtures of the vari-ous compounds should also prove to be effective disinfectants. (Author's abstract)

ECONOMIC EVALUATION OF AIR STRIP-PING TO REMOVE VOLATILE ORGANIC COMPOUNDS FROM WATER,

Construction Engineering Research Lab. (Army).

Champaign, IL. H. H. Zaghloul, R. O. Ball, and S. W. Maloney. H. H. Zaghloul, K. O. Ball, and S. W. Maloney. Available from the National Technical Information Service, Springfield, VA 22161, as AD-A190 376. Price codes A04 in paper copy, A01 in microfiche. USA-CERL Technical Report N-87/23, December 1987. 53p, 6 fig, 2 tab, 14 ref, 2 append.

Descriptors: *Economic evaluation, *Water treatment, *Air stripping, *Volatile organic compounds, Costs, Maintenance, Economic aspects, Wastewater treatment facilities.

This report documents the results of a study conducted to provide a basis for estimating the costs of ducted to provide a basis for estimating the costs of installing and using air stripping to remove volatile organic compounds (VOCs) from water. The air-stripping technology was found to be a very economical and efficient method for contaminant removal. The technology is simple, relatively inexpensive to install, and has low labor and maintenance requirements. VOC removal rates range from 90% to 99.99%. Estimated costs, in terms of percentage of total production costs, were found to be 40% for capital costs, 50% for operational costs, and 10% for maintenance costs, according to literature sources. Results of a survey conducted during this study generally agree with these percentages, except that maintenance costs reported on the survey were lower due to the highly autoon the survey were lower due to the highly automated nature of new installations. (Author's abstract) W89-02976

SUPERFUND RECORD OF DECISION: VEGA

ALTA, PR.
Environmental Protection Agency, Washington,
DC. Office of Emergency and Remedial Response.
For primary bibliographic entry see Field 5G.
W89-02984

RESULTS OF EXPERIMENTS RELATED TO CONTACT OF MINE-SPOILS WATER WITH COAL, WEST DECKER AND BIG SKY MINES, SOUTHEASTERN MONTANA, Geological Survey, Helena, MT. Water Resources

For primary bibliographic entry see Field 5B.

APPENDICITIS EPIDEMIC FOLLOWING INTRODUCTION OF PIPED WATER TO ANGLE-

SEY, Southampton General Hospital (England). D. J. P. Barker, J. A. Morris, S. J. Simmonds, and R. H. P. Oliver.

Journal of Epidemiology and Community Health JECHDR, Vol. 42, No. 2, p 144-148, June 1988. 1 fig, 3 tab, 10 ref.

Descriptors: *Domestic water, *Public health, *Enteric bacteria, *Human pathology, *Water conveyance, *England, Potable water, Appendicits.

The Public Health Acts in the late 19th Century have been inconclusively linked with the steep rise in Britain's rate of appendicitis at the beginning of have been inconclusively linked with the steep rise in Britain's rate of appendicitis at the beginning of this century. Improvements in hygiene resulting from improved sanitation systems greatly reduced exposure of young children to enteric organisms, demonstrated by the fall in childhood mortality from diarrheal disease. It has been postulated that this altered the response of enteric or respiratory infections in late childhood and adult life in such a way that they trippered acute ampredicitie. This way that they triggered acute appendicitis. This hypothesis suggests that the decline in appendicitis rates in Britain since the 1930s is due to reduced rates in Britain since the 1930s is due to reduced encounters with triggering infections as a result of continued improvements in hygiene. This hypothesis was tested by analyzing an epidemic of appendicitis in Anglesey, North Wales, 30 years ago, after piped water supplies and the consequent domestic hot water systems were introduced there. The outbreak occurred while appendicitis rates were falling elsewhere in Britain. Records of houses in England and Wales having piped water, water closets, hot water systems, and fixed baths, taken during decennial concensus in 1951, 1961, and closets, hot water systems, and fixed baths, taken during decennial concensus in 1951, 1961, and 1971, were used for data as were the addresses of those undergoing appendectomy at three Anglesey hospitals. Age-sex standardized appendicitis rates for Anglesey in 1978-82 were obtained from Hospital Activity Analysis data. From the results, it was concluded that the rise and fall of appendicitis rates in Anglesey during the past 50 years is evidence that epidemics of the disease result from the introduction of modern, bysiene practices of dence that epidemics of the disease result from the introduction of modern hygiene practices, of which domestic hot water systems and fixed baths are important components. The magnitude and duration of the epidemic will depend on the speed with which the transition to full 'western' hygiene is effected. (Friedmann-PTT) W89-03041

STUDIES OF PERMEATION OF GASES WITH DISINFECTING ACTION ACROSS POLYMER BARRIERS.

Hoelzle and Chelius G.m.b.H., Neu-Isenburg (Ger-

many, F.R.).
A. Affonso.
Zeitschrift fuer Wasser - und Abwasser Forschung
21ZWAGAQ, Vol. 21, No. 4, p 144-148, August
1988. 8 fig, 1 tab, 6 ref.

Descriptors: *Water treatment, *Physiochemical properties, *Membrane processes, *Permeability, *Disinfection, Chlorine, Chemical reactions, Oxidation-reduction potential, Barriers, Chemical

The physico-chemical phenomena that take place on the surface of a polymer barrier (polyethylene) when a disinfection gas (chlorine) permeates across it has been studied. A cartridge marketed under the name 'DIFFU-MAX' was investigated. The cartridge is meant for the disinfection of limited permeation of hypochlorous acid. Results showed an unusually high redox potential (1000 mV) measured at the surface of the cartridge. A standard suspension of Pseudomonas aeruginosa made to stream over the surface showed a 100% kill at flow rates of 4-6 ml/min. The cartridge diffused 5-20 mg of hypochlorous acid acid over a long period of time (80 days). Proof that only hypochlorous acid permeates across the polymer of the cartridge was obtained by NMR and EIR spectral analysis of a small amount of water, kept in permanent contact physico-chemical phenomena that take place small amount of water, kept in permanent contact with an activated cartridge for several days. Fur-ther work with other gases is in progress. (Author's abstract) W89-03044

YOU AND YOUR DRINKING WATER: HEALTH IMPLICATIONS FOR THE USE OF CATION EXCHANGE WATER SOFTENERS, North Dakota Univ., Grand Forks. School of

Medicine

G. Das. Journal of Clinical Pharmacology JCPCBR, Vol. 28, No. 8, p 683-690, 1988. 1 fig, 6 tab, 37 ref.

Descriptors: *Drinking water, *Water softening, *Public health, Water quality, Sodium, Calcium, Magnesium, Cation exchange.

Home use of water softeners has greatly increased in the past decades, with an estimated 12-13 million home water softeners in operation in the USA. Almost all of the water softeners for home use are of the cation exchange variety, the most common of which employs sodium as the exchange cation.

The fact that these softeners require periodic addition of sodium chloride for efficient operation, a well as removing calcium and magnesium from the water, has raised concerns for the health implications of these water softeners. Epidemiological studies have found an association between soft water and coronary heart disease. Higher inci-dence of arterial hypertension has been linked to consumption of water with naturally high sodium content or use of water treated by home water softeners compared with water of low sodium con-tent. The removal of calcium from the drinking water also has health implications in view of the incidence of osteoporosis in subjects with dietary incidence of osteoporosis in subjects with dietary calcium deficiency, and the fact that increased calcium intake has been shown to lower blood pressure. Studies have also found a significantly lower myocardial magnesium concentration and higher mortality from sudden death in residents of soft water areas compared to those from hard water areas, which indicates that removal of magwater areas, which indicates that removal of mag-nesium by water softener treatment may have im-portant nutritional consequences. As more empha-sis is being placed on water quality in patients on restricted sodium intake, recommendations are pre-sented for avoiding the high sodium in water caused by the use of cation exchange softeners. These include plumbing modifications which will bypass the cooking and drinking water supply to the kitchen prior to softening, or attaching the water softener to the hot water supply only, so that cold water used for cooking and drinking will that cold water used for cooking and drinking will bypass the softener. The use of substitute bottled water and soft drinks for cooking and drinking is also discussed. (Author's abstract) W89-03060

UTILIZATION OF BIOLOGICAL METHODS IN GROUNDWATER TREATMENT.

Kuopio Water District Office (Finland) E. Malkki.

Water Science and Technology WSTED4, Vol. 20, No. 3, p 129-132, 1988. 3 ref.

Descriptors: *Groundwater, *Water treatment, *Biological treatment, Iron, Manganese, Nitrate, Nitrogen removal.

Biological water treatment has been used for more than a century. The processes involved, however, have not been optimally utilized, since knowledge about their character and significance has been insufficient. As conventional water purification techniques developed, the use of biological processes remained in the background until a few dec-ades ago. However, at the moment several biologi-cal treatment methods are in use to remove iron and manganese from groundwater, and the future looks promising. The same methods can be used to improve numerous other water quality parameters, e.g. to oxidize reduced nitrogen compounds into nitrates. Biological removal of nitrate, too, will be a future water treatment method. (Author's abstract) W89-03088

TREATMENT OF GROUNDWATER WITH SLOW SAND FILTRATION,

National Board of Waters, Helsinki (Finland).

T. Hatva.

Water Science and Technology WSTED4, Vol. 20, No. 3, p 141-147, 1988. 2 fig, 3 tab, 17 ref.

Water Treatment and Quality Alteration—Group 5F

Descriptors: *Biofiltration, *Groundwater, *Water treatment, *Sand filters, *Biological treatment, Iron, Manganese, Ammonium, Pilot plants.

The purification process and techniques of the slow sand filtration method for treatment of groundwater was studied on the basis of pilot plant and full scale tests and studies of waterworks, to and full scale tests and studies of waterworks, to obtain guidelines for construction and maintenance. The purification process consists in general of two principal phases, i.e. pre-treatment and slow sand filtration. Both are biological filters. The main purpose of the pre-treatment is to reduce the iron content of raw water, in order to slow down the clogging of the slow sand filters. Different types of biofilters have proved very effective in the pre-treatment phase, with reduction of total iron from 50% to over 80%. During the treatment, the oxidation reduction conditions gradually change, becoming suitable for chemical and biological pre-cipitation of iron, manganese and for oxidation of ammonium. Suitable environmental conditions are crucial in the oxidation of manganese and ammoniammonium. Suitable environmental condutions are crucial in the oxidation of manganese and ammoni-um which, according to these studies, mainly occurs at the end of the process. Low water tem-perature in winter does not seen to prevent the biological activities connected with the removal of onological activities connected with the removal of iron, manganese and ammonium, the chief proper-ties necessitating treatment of groundwater in Fin-land. (Author's abstract) W89-03090

VYREDOX AND NITREDOX METHODS OF IN SITU TREATMENT OF GROUNDWATER, Technion - Israel Inst. of Tech, Haifa. C. Braester, and R. Martinell. Water Science and Technology WSTED4, Vol. 20, No. 3, p 149-163, 1988. 9 fig, 3 tab, 5 ref.

Descriptors: *Groundwater, *Water treatment, *Biological treatment, *Biological wastewater treatment, Vyredox method, Nitredox method, Iron, Manganese, Nitrates, Nitrites, Hydrocarbons, Injection wells.

During the past two decades, alternatives to the traditional method of treating groundwater in filters have been developed. The most common problem regarding groundwater is the high content of iron and manganese, which can be reduced by the VYREDOX method. In some areas there tent of iron and manganese, which can be reduced by the VYREDOX method. In some areas there are also severe problems with pollution by hydrocarbons and nitrate. A modification of the VYREDOX method, known as the NITREDOX method, can be used for hydrocarbon and nitrate treatment. In both methods water from a chemical or biological treatment plant is introduced into the aquifer using injection wells. The chemistry of the groundwater is thus modified. The VYREDOX idea is to compensate for the lack of oxygen in groundwater rich in iron and manganese, and thus to turn the balance of the chemical system in the aquifer toward the oxidative side. Today there are more than a hundred VYREDOX plants in more than ten countries. NITREDOX plants in more than ten countries. NITREDOX is an in-situ denitrification method which, with the help of naturally-existing microorganisms, reduces nitrate and nitrite to an acceptable level. Today there are several NITREDOX plants on line and, due to severe nitrate and nitrite pollution problems, it appears there will be an important need for this method in the future. Problems that have occurred in connection with these methods are of the following kinds:

(A) Unsatisfactory dimensioning and construction of wells; (B) shortage of injection water; (C) mistakes in plant operation; and (D) Imperfect location of injection wells. These problems have been eliminated without any extensive repercussions. (See also W89-03092) (Sand-PTT)

MODELLING OF FLOW AND TRANSPORT PROCESSES IN VYREDOX AND NITREDOX SUBSURFACE TREATMENT PLANTS, Technion - Israel Inst. of Tech., Haifa. C. Braester, and R. Martinell. Water Science and Technology WSTED4, Vol. 20, No. 3, p 165-172, 1988. 2 ref.

Descriptors: *Groundwater, *Water treatment, *Biological treatment, *Oxidation process, Vyre-

dox method, Nitredox method, Iron, Manganese, Nitrates, Nitrites, Injection wells, Model studies.

Vyredox plants are designed for in situ removal of iron and/or manganese, while Nitredox plants are designed for in situ removal of nitrates and nitrites. Both methods make use of bacteriological processes. A typical unit of a Vyredox plant comprises several injection wells, through which degassed aerated water is injected into the aquifer and a pumping well through which water, partly free of tron or manganese, is abstracted. A typical Nitredox plant comprises a number of injection-pumping wells located on the circumference of two ing wells located on the circumference of two concentric circles and a pumping well in the center through which water, partly free of nitrates and iron and/or manganese, is produced. Water with the carbon nutrient is injected through the wells located on the outer circle, while the wells located on the inner circle play the role of the Vyredox injection wells. The Nitredox process is associated with the formation of nitrogen, which is removed through the wells located on the inner circle. Vyr-edox and Nitredox processes include flow phenom-ena, transport, chemical reactions and bacteriologi-cal processes. These phenomena are described and cal processes. These phenomena are described and formulated mathematically as a first step in the mathematical modeling of such processes. (See also W89-03091) (Author's abstract)

BIOTECHNOLOGY FOR MANGANESE RE-MOVAL FROM GROUNDWATER, Research and Design Inst. of Public Works and Utilities, Sofia (Bulgaria). T. Peitchev, and V. Semov. Water Science and Technology WSTED4, Vol. 20, No. 3, p 173-178, 1988. I fig, 1 tab, 7 ref.

Descriptors: *Groundwater, *Water treatment, *Biological treatment, *Manganese, Terrace waters, Bacteria, Oxygen, Sand filters.

This paper presents the results of investigations into the purification of river terrace groundwaters containing manganese up to 3 mg/l. If manganese containing manganese up to 3 mg/l. If manganese is present in the terrace waters, it is always accompanied by manganese oxidizing bacteria. Based on this, a process was developed for the biological removal of manganese without the use of chemical reagents. This biomanganese process has a high efficiency and reliability under the following conditions: (1) the raw water must contain manganese-oxidizing bacteria; (2) the water must contain a sufficient quantity of dissolved oxygen and nutrient elements; (3) the water must be filtered through manganese-covered 'black sand'; (4) filter flushing must be carried out with water which does not must be carried out with water which does not contain bactericidal substances; (5) the flushing wastewater must be settled first, and then recycled for repeated flushing; and (6) filter loading with or repeated flushing; and (6) filter loading with divalent manganese ion must not reach the oxida-tion-capacity limit of the filter. The technology was implemented under operational conditions in 1982, and has given stable treatment to date. (Sand-PTT) PTT) W89-03093

BIOLOGICAL TREATMENT OF GROUND-WATER IN BASINS WITH FLOATING FIL-TERS: I. TEST ARRANGEMENTS AND GEN-ERAL RESULTS, Kuopio Water District Office (Finland). E. Malkki.

Water Science and Technology WSTED4, Vol. 20, No. 3, p 179-184, 1988. 2 fig, 1 tab, 5 ref.

Descriptors: *Groundwater, *Water treatment fa-cilities, *Water treatment, *Biological treatment, *Filtration, Iron, Manganese, Floating filters, Sand

This study describes the biological treatment of groundwater, in particular the removal of iron and manganese in basins primarily equipped with floating coarse-grained filters that constitute the pretreatment unit. In this unit, which complements the sand filter and is actually the principal treatment unit, water flows recurrently through the floating filter and through the boundary surface between air and water. This promotes chemical oxidation,

creates favorable conditions for biological activity and accelerates the sedimentation of the precipitate on the bottom of the basins. In the pre-treatment unit the precipitation process for iron in the different test plants started effectively within 1 to 5 months, with an 82-95% reduction of iron; 0-83% of the manganese was reduced, but at some of the plants this time was insufficient to start the precipitation process. After the sand filtration unit iron was almost totally removed and at three test plants the manganese reduction was at least 80%. The groundwater treatment result is influenced in a decisive way by technical arrangements and the physicochemical and microbiological quality of the raw water. (See also W89-03095) (Author's abstract) W80 U3004

BIOLOGICAL GROUNDWATER DENITRIFI-CATION: LABORATORY STUDIES,

CATION: LABORATORY STUDIES,
Ben-Gurion Univ. of the Negev, Sde Boker
(Israel). Jacob Blaustein Inst. for Desert Research.
M. I. M. Soares, S. Belkin, and A. Abeliovich.
Water Science and Technology WSTED4, Vol.
20, No. 3, p 189-195, 1988. 6 fig. 1 tab, 10 ref.
National Council for Research and Development,
Israel, Grant No. WT 573/369 and European Economic Community Grant No. 2637186.

Descriptors: *Groundwater, *Water treatment, *Biological treatment, *Groundwater pollution, *Denitrification, Sand column, Nitrates.

Laboratory denitrification studies were conducted in a sand column using sucrose as a biodegradable carbon source. The denitrification capacity of the system was followed for more than a year. Column system was followed for more than a year. Column efficiency was dependent on the flow rate and on the carbon to nitrogen ratio in the treated water. After a few months of operation, visible accumulation of gas in the active zone was accompanied by a marked decrease in column permeability. Vacuum treatment restored permeability to soriginal level; only partial recovery was achieved by simply allowing the slow natural release of gas. Under the conditions tested, clogging may have resulted from the accumulation of microbiologically produced gas. (Author's abstract)

EXTENDED PERIOD SIMULATION OF WATER SYSTEMS – DIRECT SOLUTION, Visvesvaraya Regional Coll. of Engineering, Nagpur (India). Dept. of Civil Engineering. P. R. Bhave.

JOURNAL OF Environmental Engineering (ASCE) JOEDDU, Vol. 114, No. 5, p 1146-1159, October 1988. 3 fig, 10 tab, append.

Descriptors: *Water distribution, *Mathematical models, *Systems analysis, *Model studies, Flow rates, Extended period simulation, Dynamic analysis, Comuter programs.

Extended period simulation or dynamic analysis of water distributions systems helps in their proper operation by checking whether the flow rates are maintained at adequate pressures at all nodes and whether the storage properly balances the supply and distribution. A direct procedure is developed and illustrated for such dynamic analysis. The procedure can be applied to formulate discharge in pipe, change in discharge, or head at node equations and therefore dynamic analysis can be directly obtained by the usual linear theory, or by the Newton-Raphson of Hardy Cross methods of static network analysis. The available computer programs based on any of these methods can be used, with minor modifications, for carrying out dynamic analysis of water-distribution systems. (Author's abstract) Extended period simulation or dynamic analysis of abstract) W89-03106

SEQUESTRATION OF IRON IN GROUND-WATER BY POLYPHOSPHATES,

WAIER BY PULITHUSTHAIRS, Space Command, Peterson AFB, CO. K. G. Klueh, and R. B. Robinson. Journal of Environmental Engineering (ASCE) JOEDDU, Vol. 114, No. 5, p 1192-1199, October

Group 5F-Water Treatment and Quality Alteration

Descriptors: *Iron, *Water treatment, Iron sequestration, Polyphosphates, Chemical treatment

For small communities, iron removal from ground-For small communities, iron removal from ground-water supplies by conventional methods is some-times cost prohibitive. An experimental investiga-tion was conducted to determine the effectiveness of sequestering this iron by polyphosphate addition while providing the necessary disinfection through chlorine addition. Iron sequestration by polyphos-phate was found favorable to no iron treatment. The presence of calcium in the groundwater models inhibited treatment effectiveness. The poly-phosphate sequestrant should be added to the groundwater before the addition of chlorine but simultaneous addition was nearly as successful. groundwater before the addition of chlorine but simultaneous addition was nearly as successful. The commercial polyphosphates analyzed were not found to depolymerize significantly at 18 C during typical drinking water supply storage time periods. Treatment was better with the polyphosphate product containing a higher percentage of polyphosphate product containing a higher percentage of polyphosphate relative to total phosphorus. Ultrafiltration results suggest that much if not all the sequestered iron is in colloidal or polymeric form. (Author's abstract)

KINETICS OF LOW SOLIDS BIO-DENITRIFI-CATION OF WATER SUPPLIES, Nebraska Univ.-Lincoln. Dept. of Civil Engineer-

y. W. Lee, and M. F. Dahab.
Journal - Water Pollution Control Federation
JWPF45, Vol. 60, No. 10, p 1857-1861, October

Descriptors: *Kinetics, *Denitrification, *Water treatment, *Model studies, Groundwater pollution, *Mathematical models, Packed beds, Substrates.

The potential of biological denitrification using packed-bed reactors for nitrate removal from contaminated potential drinking water supplies with high nitrate concentrations was investigated. Based on experiment results, a simplified kinetic model can be used to approximate the substrate utilization rate in attached biofilms for low solids denitrification systems. This conclusion is based on the assumption that the biofilm is fully penetrable by the substrate and that mixing or intimate contact is provided between the biofilm and the substrate in the bulk solution. Data collected in batch denitrification experiments using both suspended and at The potential of biological denitrification using the bulk solution. Data collected in batch denitrifi-cation experiments using both suspended and at-tached biomass agreed with the proposed relation-ship. However, it seems that the biofilm was prob-ably less than fully penetrable. Based on solids accumulation data, the primary workhorses of static-bed reactors seem to be the free biomass suspended in the medium matrix. (Vernooy-PTT) W89-03166

IN VITRO GENOTOXICITY OF CHLORINAT-ED DRINKING WATER PROCESSED FROM HUMUS-RICH SURFACE WATER.

National Public Health Inst., Kuopio (Finland). Dept. of Environmental Hygiene and Toxicology. For primary bibliographic entry see Field 5C. W89-03202

GEOMEMBRANE LINER REDUCES LEAK-AGE IN UNDERGROUND RESERVOIR, Cincinnati Water Works, OH.

P. Tomes, G. Fisher, and W. Way. Public Works PUWOAH, Vol. 119, No. 10, p 115-

Descriptors: *Underground structures, *Reservoirs, *Reservoir linings, *Geomembrane, *Sealants, Leakage, Water storage, Underground storage, Cincinnati, Ohio, Cost analysis.

The problem of the leakage of underground struc-tures is discussed with regard to the Eden Park Reservoir located in Cincinnati, Ohio. Over a 20-year period, the water works department attempted to apply new technologies in an effort to curb the leak loss rate, while at the same time keeping

an important finished water storage facility in service. The solution came in the form of lining the reservoir with a flexible geomembrane. Three sealing alternatives were examined: (1) a concrete overlay; (2) an adhered membrane applied as a liquid; and (3) a loose-laid geomembrane system. The geomembrane material was chosen, in part, because of its documented resistance to moisture and visidation and its shifty to remain flexible over because of its documented resistance to moisture and oxidation and its ability to remain flexible over a wide range of temperature. Because there was concern for the types of solvents used in the bond-ing agents of adhesives used, water quality tests were performed. Results of the tests showed that organic levels varied between suppliers but when seam samples were exposed to a water bath approximating the seam-to-water volume ratio expected in the finished reservoir, the concentrations measured were well below current standards. The specified system adapted well to the complex and specimed system adapted when to the complex and tedious installation requirements and ultimately yielded a successful project. Based on these results, the Cincinnati Water Works is proceeding with plans to line another large potable water storage facility that should net the department even greater savings. (Miller-PTT) W89-03281

HALAMINE WATER DISINFECTANTS,

HALAMINE WATER DISINFECTANTS, Auburn Univ., AL. Dept. of Chemistry. S. D. Worley, and D. E. Williams. CRC Critical Reviews in Environmental Control CCECAU, Vol. 18, No. 2, p 133-175, 1988. 20 fig, 14 tab, 142 ref. U.S. Army Research Medical Re-search and Development Command Contract DAMD17-82-C-2257.

Descriptors: *Water treatment, *Disinfectants, *Halamines, Potable water, Giardia, Disinfection, Performance evaluation, Cooling towers, Air conditioning, Swimming pools.

The development of a new general purpose water disinfectant is discussed with particular emphasis on N-halamines. An N-halamine can be defined as a compound containing one or more nitrogenhalogen covalent bonds which liberates positive halogen in water. Several new organic N-halamines which have excellent potential as stable, broad-spectrum water biocides are discussed. For long-term disinfection applications for which stability is more important than brief contact time and noncorrosive biocides are required (cooling towers, air conditioning, hot tubs), different structures of N-halo oxazolidinone and N,N'-dihaloimidazolidinone (compounds I) disinfectants show great promise, with different specific applications for the different compounds. All of the new compounds are effective against Giardia lamblia and thus may be useful for disinfection of potable water in remote locations such as campgrounds. Howevtrius may be useful for distintection of potable water in remote locations such as campgrounds. However, additional toxicity data on the new compounds are required before their commercial potential can be realized. (Miller-PTT) W89-03285

CONCENTRATION OF MYCOBACTERIUM AVIUM BY HOSPITAL HOT WATER SYSTEMS,

Harvard Medical School, Boston, MA. Dept. of For primary bibliographic entry see Field 5B. W89-03304 Anaesthesia.

SEWAGE HARDNESS AND MORTALITY FROM CANCER AND CARDIOVASCULAR

Morehouse School of Medicine, Atlanta, GA.
Dept. of Community Health/Preventive Medicine.
For primary bibliographic entry see Field 5D.
W89-03309

DEGRADATION OF BROMOFORM AND CHLORODIBROMOMETHANE IN A CATA-LYZED H2-WATER SYSTEM,

Harbor Branch Oceanographic Institution, Inc., Fort Pierce, FL. For primary bibliographic entry see Field 2K. W89-03311

TREATMENT OF POTABLE WATER FROM SEOUL, KOREA BY FLOTATION, FILTRATION AND ADSORPTION, Krofta Engineering Corp., Lenox, MA. M. Krofta, and L. K. Wang. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-200530. Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. LIR/03-85/123, March 1985. 23p, 1 fig, 4 tab, 14 ref, append. Krofta Engineering Corp. Grant J8503-42.

Descriptors: *Water treatment, *Potable water, Descriptors: "Water treatment, "Potable water, "Seoul, "Flotation, "Filtration, "Adsorption, *Korea, Sandfloat, Chemical treatment, Turbidity, Alum, Sodium aluminate, Granular activated carbon, Chemical oxygen demand, Biological oxygen demand, Organic compounds.

An innovative Sandfloat process system consisting of chemical feeding, dissolved air flotation, filtra-tion and disinfection has been demonstrated to be feasible for potable water treatment in Korea by laboratory bench-scale tests. Higher than 90% of naturatory temenscare tests. Higher than 50% of the turbidity removal can be easily achieved when alum, sodium aluminate and anionic polyelectrolyte are used as the coagulants. The backwash wastewater is recycled to the intake unit; thus the wastewater is recycled to the intake unit; thus the entire system produces no wastewater except the highly concentrated scum from the top of the flotation unit. The Sandfloat effluent meets the U.S. EPA Drinking Water Standards on pH, turbidity, color, total coliform, and heavy metals. Additional treatments by granular activated carbon and chlorination guarantee satisfactory removal of residual COD, BOD, THM formation potential, foaming agent and bacteria. Both the capital and annual correction and waintenance costs of the annual operation and maintenance costs of the newly developed Sandfloat-GAC process system newly developed Sandfloat-GAC process system are much lower than that of a conventional water purification system consisting of chemical feeding, rapid mixing, flocculation, sedimentation, gravity filtration, granular activated carbon, and disinfection. The new system is small and compact, and is particularly useful for treatment plants with limited land space. Recycling of filter backwash wastewater for reproduction of drinking water is a very promising approach for pollution control and water conservation. (Author's abstract) W89-03319

5G. Water Quality Control

PATAPSCO WASTEWATER TREATMENT PLANT TOXICITY REDUCTION EVALUATION, TREATMENT

Engineering-Science, Fairfax, VA.
For primary bibliographic entry see Field 5D.
W89-02300

MONITORING, RESEARCH, AND MANAGE-MENT: INTEGRATION FOR DECISIONMAK-ING IN COASTAL MARINE ENVIRONMENTS, National Oceanic and Atmospheric Administra-tion, Rockville, MD. Ocean Assessments Div. For primary bibliographic entry see Field 5A. W89-02323

IMPLICATIONS OF THE CLEAN WATER ACT AND SAFE DRINKING WATER ACT LEGISLA-TION FOR SOUTHWESTERN INDIAN TRIBES: WATER-QUALITY MANAGEMENT AND INDIAN SELF DETERMINATION, Bureau of Indian Affairs, Albuquerque, NM. Albu-

querque Area Office. J. G. Wells.

IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 31-

Descriptors: *Indian tribes, *Water rights, *Water quality, *Water supply systems, *Water law, *Clean Water Act, *Safe Drinking Water Act, Aquifers, Water resources development, Political aspects, Groundwater.

The concepts of Indian water-quality management include the identification of ground and surface

water sources, the measurement and recording of water-quality information, establishment of water-quality standards, issuance of permits to control water uses and quantity and quality, development of water codes, the creation of an Indian water management agency to administer codes and participate in their enforcement, and also funding and assistance sources including trib... Federal, State, and local sources. The Clean Water Act and Safe Drinking Water Act amendments have created an avenue whereby recognized Indian tribes can participate in their own water management thus achieving some self-determination. But the Acts do not recognize the variety of Indian nations and unique governmental structures that are different from most state governments. The EPA is recognizing these tribal issues now and developing regulations which provide some flexibility for the tribal programs. Strategies have been developed by the EPA and are recognized as the CWA and SDWA regulations are published. Strategies have also been developed by the Indian Health Service and Bureau of Indian Affairs whose trust responsibilities have included data gathering and data management for a wide variety of water-quality issues and by other government agencies in their willingness to share data and technical expertise. The new regulations, Federal funding and assistance, state and local assistance, and the tribes' developed water management programs (perhaps with an Indian water management gency) will result in the eventual tribal self-determination of their water management programs. (See also W89-02331) (Al-exander-PTT)

IMPACTS OF RECHARGE LEGISLATION ON GROUNDWATER MANAGEMENT IN ARIZO-

Arizona Dept. of Environmental Quality, Phoenix. For primary bibliographic entry see Field 4B. W89-02336

DRY WELLS - SOLUTION OR POLLUTION: AN ARIZONA STATUS REPORT, Arizona Dept. of Environmental Quality, Phoenix. For primary bibliographic entry see Field 5B. W89-02338

IMPACT OF THE NEWPORT-INGLEWOOD STRUCTURAL ZONE ON HYDROGEOLOGIC MITIGATION EFFORTS: LOS ANGELES BASIN, CALIFORNIA, Engineering Enterprises, Inc., Long Beach, CA. For primary bibliographic entry see Field 2F. W89-02342

ROLE OF AQUIFER TESTING IN DESIGN OF CONSTANT-HEAD EXTRACTION SYSTEMS, Pacific Environmental Group, Inc., Santa Clara,

For primary bibliographic entry see Field 7B. W89-02346

IN-SITU HYDROCARBON EXTRACTION, A CASE STUDY, Converse Environmental Consultants California,

Passacena.
E. W. Fall, and W. E. Pickens.
IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 415-437, 10 fig, 4 ref.

Descriptors: *In situ extraction, *Hydrocarbons, *Cleanup, *Water pollution treatment, *Gasoline, *Groundwater pollution, Groundwater monitoring, Design criteria, Design standards, Infiltration, Organic compounds, Biodegradation.

Vacuum extraction technology is being used successfully to strip hydrocarbon contaminants from vadose zone soils at the site of an underground gasoline spill in Burbank, California. System design employs several vacuum extraction wells and perimeter air infiltration wells to stimulate subsurface air flow and volatilize hydrocarbon contaminants.

Aboveground treatment equipment, consisting of a

thermal combustor and catalytic oxidizer, converts recovered vapors to non-hazardous substances. System operation has progressed daily since June 1987. Monitoring of flow rate and contaminant concentrations in the vacuum line indicates that approximately 1600 gallons were recovered during the first 221 hours of operation. Additional monitoring data from 30 soil-gas piezometers confirms that in-situ hydrocarbon concentrations are declining. Reduced oxygen levels and elevated concentrations of carbon dioxide in soil-gas samples sugtrations of carbon dioxide in soil-gas samples sug-gest that subsurface air flow is promoting bacterial gest that subsurrace air frow is promoting oacternal growth in soils further accelerating site cleanup. To date system performance has met or exceeded design estimates. Current projection is that full site mitigation may be accomplished within one year. (See also W89-02331) (Author's abstract) W89-02354.

PERMEABLE BARRIERS: A NEW ALTERNA-TIVE FOR TREATMENT OF CONTAMINATED GROUND WATERS, New Mexico Univ., Albuquerque, Dept. of Civil

Rew Mexico Oniv., Albuquerque. Dept. of Civil Engineering. B. M. Thomson, and S. P. Shelton. IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 441-453, 4 fig. 2 tab, 14 ref.

Descriptors: *Water pollution treatment, *Permea-ble barriers, *Membrane processes, *Groundwater pollution, Groundwater monitoring, Biodegrada-

Management of groundwater contamination prob-lems have two fundamental objectives. First is containment of the pollutants. Conventional concontainment of the pollutants. Conventional con-tainment technology is based on the use of either physical barriers or hydraulic containment using well systems to limit contaminant migration. The second objective is removal or destruction of the contaminant and restoration of groundwater qual-ity. Current treatment technologies for polluted groundwater are limited to treatment of the water oroundwater are limited to treatment of the water at the surface, followed by reinjection or surface disposal. In-place biodegradation methods appear promising for some organic contaminants, however, these methods are still experimental. A proposed method is proposed which involves development of barriers which are permeable to groundwater but limit contaminant migration. These barriers achieve the dual goals of containment and treatment of the contaminated groundwater. Two general types of barriers are possible. First, in shallow aquifers trench-based barriers may be constructed in the flow path of the contaminated groundwater. Media placed in the trench might include adsorbents, ion exchange materials, or microbial growth media to enhance pollutant degradation. Well-based barriers would be used in deeper systems and would consist of injection wells in which the chemical characteristics but not the hydraulic characteristics of the aquifer were the hydraulic characteristics of the aqu ne nydraunc cnaracteristics of the aquifer were altered. An example might be injection of microbial growth media to enhance biodegradation. Development of the trench-based barrier concept is discussed. Examples are presented of active and passive containment and treatment alternatives. (See also W89-02331) (Author's abstract) W89-02355

USE OF WELL PACKERS TO CONTROL TCE AND PCE CONTAMINANTS, Los Angeles City Dept. of Water and Power, CA. G. Coufal, R. Nagel, and P. Rogalsky. IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 455-477, 9 fig. 4 tab, 5 ref.

Descriptors: *California, *Water pollution treatment, *Well packers, *Los Angeles, *Chlorinated hydrocarbons, *Drinking water, *Groundwater pollution, Groundwater monitoring, Organic compounds, Hydrocarbons, Aquifers, Path of pollut-

Organic contaminants were discovered in Los Angeles' wells in early 1980. Since that time, trichloroethylene (TCE) and/or tetrachloroethylene

Water Quality Control-Group 5G

(PCE) contaminants have been found in 39 of Los Angeles' 75 production wells in concentrations greater than limits set by the California State Department of Health Services. About 10 of the 39 wells can be used by blending water containing little or no TCE and/or PCE. The remaining wells have been placed out of service. Options considered in order to place these wells back in service included treatment of the contaminated water and pumping from the lower portion of the aquifer. The second option is discussed. After previous tests indicated that the highest concentrations of TCE and PCE were restricted to the upper portion of the aquifer, well packers were installed in a zone of low permeability in 14 wells in the North Hollywood area of the San Fernando Valley in an attempt to restrict the vertical movement of groundwater containing high levels of organic contaminants (TCE and PCE) from the upper portion of the aquifer to the lower portion of the well and subsequent pump intake. Results varied depending on localized conditions at each well. (See also W89-02331) (Author's abstract) W89-02356

DESIGN AND CONSTRUCTION OF A SUB-SURFACE GASOLINE RECOVERY SYSTEM WESTMINSTER, COLORADO,

Chen and Associates, Denver, CO. D. R. Ganser, and R. J. Tocher.

D. N. Cranser, and R. J. Tocher.
IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 479-486, 4 fig.

Descriptors: *Colorado, *Water pollution treat-ment, *Gasoline, *Groundwater pollution, *Moni-toring wells, Organic compounds, Hydrocarbons, Hydraulic conductivity, Infiltration, Design stand-ards, Aquifers.

ards, Aquiters.

The loss of up to 100,000 gallons of gasoline from a recently constructed fueling system at the Westminster Service Center was discovered in the summer of 1986. Immediate recovery measures were initiated along with the complete delineation of the gasoline plume using soil-gas and standard monitoring well techniques. The gasoline plume was found to be floating on top the groundwater table which was located within the Denver Formation consisting of interbedded claystones and sandstones. Efficient product recovery using wells was not deemed feasible due to the relatively low hydraulic conductivity of the Denver Formation and discontinuous nature of the sandstone lenses. As a result an infiltration or interceptor trench was installed at the down gradient limit of the gasoline plume in addition to recovery wells located near the source. The wells were designed to enhance product recovery during the early stages of system. product recovery during the early stages of system operation. The recovery system consisted of a total fluids pumping system operated by compressed air, an above groundwater separator, a product recovery tank and associated controls and monitors. The ery tank and associated controls and monitors. In exystem has been operated for approximately 1 year, recovering nearly 30,000 gallons of product which is being reused by the City of Westminster. (See also W89-02331) (Author's abstract) W89-02357

ADVANTAGES OF SUCTION LIFT HYDRO-CARBON RECOVERY SYSTEMS: APPLICA-TION AT THREE HYDROGEOLOGIC ENVI-RONMENTS IN CALIFORNIA, Engineering Enterprises, Inc., Long Beach, CA. E. C. Henry, D. Hayes, E. A. Hodder, and S. M.

IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 487-

Descriptors: *California, *Water pollution treat-ment, *Pumping, *Suction lift recovery systems, *Hydrocarbons, *Organic compounds, *Ground-water pollution, Wells, Aquifers.

Suction lift pumping systems have been used suc-cessfully for free hydrocarbon product recovery from shallow water tables in three distinctly differ-

Group 5G-Water Quality Control

ent hydrogeologic environments in California. The one similarity of the sites is that the depth to affected groundwater is within the range of < 30 feet allowable for suction lift pumping, Recovery wells were drilled by machine and/or hand auger and constructed with two to six inch diameter PVC casing. The pumping system consisted of neumatically-driven, double-diaphragm suction-lift pumps manifolded to up to four recovery wells each. Air supply for pneumatic pump operation was provided by existing on-site compressors in each case. Sealed well heads resulted in vacuum-enhanced removal of product from the formation. Discharge from individual wells averaged from below 1 gpm to above 20 gpm depending upon aquifer characteristics. Discharge could be controlled by regulation of air supply to the pumps, variation in well-head vacuum and valving of pump discharge. Wastewater discharge was handled by existing treatment or discharge permits or treated with GAC prior to surface water. The systems are considered practical as they are economical, built with existing technology, installed easily and efficiently, and require relatively low operation and maintenance. A principal advantage is the wide range in pumping rates available such that the system can be installed with minimal testing of aquifer characteristics with subsequent adjustment to the optimum rate for the subject formation. Other advantages include ease of installation of additional wells and safety of air-driven mation. Other advantages include ease of installa-tion of additional wells and safety of air-driven equipment and controls at petroleum-handling fa-cilities. (See also W89-02331) (Author's abstract) W89-02358

IN SITU AQUIFER DENITRIFICATION: RE-MEDIATION OF AMMONIA AND NITRATE CONTAMINATED SUBSURFACE ENVIRON-

MENTS, Groundwater Technology, Inc., Tempe, AZ. S. B. Wilson, A. Levine, and J. E. Goetz. IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 507-520, 5 fig, 1 tab, 4 ref.

Descriptors: *Ammonia, *Nitrates, *Denitrifica-tion, *Fertilizers, *Water pollution treatment, *Ag-ricultural chemicals, *Groundwater pollution, *Biodegradation, *Microbial degradation, *Eco-nomic aspects, Performance evaluation, Drinking water, Aquifers.

water, Adulters.

The amount of nitrogen fertilizers used on U.S. agricultural land has increased dramatically in recent decades prompting considerable concern over contamination of soils and groundwater supplies by elevated ammonia and nitrate concentrations. Recent research has indicated that nitrate concentrations in drinking water in excess of 10 mg/L may cause methemoglobinemia in small children. With this increasing need to treat ammonia and nitrate tainted subsurface environments economically, attention is being focused on in situ microbial denitrification systems. A recent ammonia contamination of groundwater occurred in the Flood Plain Alluviums of the Albuquerque-Belen Basin. In an effort to design a cost effective on-site treatment, the feasibility of in situ bioreclamation was studied to stimulate microbial denitrification. Results of a complete feasibility and optimization Results of a complete feasibility and optimization study indicated excellent denitrification in sediments and groundwater collected from the site. A decrease in ammonia concentrations from 170.0 to 3.33 ppm was attained in 11 days time in laboratory studies. A full scale in situ treatment was designed for installation. Data generated during the feasibility and optimization study are presented as well as a general presentation of in situ microbial denitrification mechanisms. Design parameters of the full scale system are also discussed. (See also W89-02331) (Author's abstract)

EFFECTS OF ACID MINE DRAINAGE ON GROUNDWATER QUALITY AT THE LEVIA-THAN SULFUR MINE, ALPINE COUNTY, CALIFORNIA, Groundwater Technology, Inc., Sacramento, CA. For primary bibliographic entry see Field 5C. W89-02363

8TH AESF/EPA CONFERENCE ON POLLU-TION CONTROL FOR THE METAL FINISH-ING INDUSTRY.

American Electroplaters and Surface Finishers Society, Orlando, FL.

ciety, Oriando, FL.
Available from the National Technical Information
Service, Springfield, VA. 22161, as PB87-208807.
Price codes: A14 in paper copy, A01 in microfiche.
EPA Report No. EPA/600/9-87/012, July 1987.
302p. Compiled by J. Howard Schumacher and
Roger C. Wilmoth.

Descriptors: *Conferences, *Metal-finishing wastes, *Water pollution control, *Wastewater treatment, *Waste disposal, *Water pollution prevention, Electroplating, Standards, Industrial wastewater, Hazardous materials, Heavy metals,

The 8th Annual AESF/EPA Conference and Exhibit on Pollution Control for the Metal Finishing Industry was held in San Diego, California, February 9, 10 and 11, 1987. The primary objective of this conference was to continue the dialogue estables of the conference was to continue the dialogue estables. this conference was to continue the dialogue estab-lished by the first AESF/EPA Conference in 1987 between key members of the Agency and the metal finishing industry. The program featured key EPA representatives who explained and discussed regu-latory guidelines in detail; in addition, leading in-dustrial experts discussed industry's efforts to ef-fectively address the ramifications of the EPA regulations. (See W89-02393 thru W89-02411) (Au-thor's abstract) W89-02392 W89-02392

HAZARDOUS WASTE RESEARCH PERTAIN-ING TO METAL FINISHING,

Environmental Protection Agency, Cincinnati, OH C. J. Dial.

IN: 8th AESF/EPA Conference on Pollution Control for the Metal Finishing Industry. EPA Report No. EPA/600/9-87/012, July 1987. p 1-12, 2 tab, 15 ref.

Descriptors: "Hazardous wastes, "Metal-finishing wastes, "Water pollution control, "Waste disposal, "Water pollution prevention, Waste management, Recycling, Incineration, Solidification, Chemical treatment.

The U.S. EPA has conducted research to evaluate The U.S. EPA has conducted research to evaluate or develop metal waste control techniques for a number of years. A brief description is presented of the more important projects that have been conducted since 1978. During the past year, work has centered on the performance assessment of commercial facilities treating these wastes and evaluation and development of a waste reduction audit procedure. Preference for the management of any waste stream is represented by the following hierwaste stream is represented by the following hierarchy: waste elimination, recycle, reuse, burn as fuel, incineration, chemical/biological detoxification, volume reduction, and solidify and dispose. There are three parts to current research efforts: (1) field performance evaluations, (2) pilot tests at the Test and Evaluation Facility in Cincinnati, and (3) examination of ways to reduce wastes. Efforts are designed to determine acceptable ways to handle or treat wastes so that they may be land disposed. (See also W89-02392) (Lantz-PTT) w89-02392 W89-02393

HOW CLEAN IS CLEAN, (WHAT CONSTITUTES THE CLEAN CLOSURE OF A HAZARDOUS WASTE LAND MANAGEMENT FA-CILITY),

HRP Associates, Inc., New Britain, CT. For primary bibliographic entry see Field 5E. W89-02399

POLLUTION CONTROL USING ROOM TEMPERATURE EVAPORATORS, Eastern Plating, Inc., Newport, TN.

R. M. Woods

IN: 8th AESF/EPA Conference on Pollution Control for the Metal Finishing Industry. EPA Report No. EPA/600/9-87/012, July 1987. p 117-121.

Descriptors: *Wastewater treatment, *Water pollu-tion control, *Evaporators, *Metal-finishing wastes, *Temperature, Industrial wastewater, Chromium, Nickel, Heavy metals, Economic as-pects, Closed loop systems, Performance evalua-tion, Sludge.

Low-energy room temperature evaporators have been added to five large automatic nickel-chrome plating machines to reclaim plating solutions and to reduce loads on a large chemical destruct system and lower the resulting metal hydroxide sludge. Room temperature evaporators offer significant advantages over high temperature-evaporators in the two example plants. Much lower capital investment, lower operating costs, lower maintenance costs, and high reliability are the primary factors justifying their use. The effectiveness of the evaporative systems are an important step toward an eventual closed-loop system. Electrolytes include nickel, hex-chrome, and tri-chrome solutions. Plant 1 (3 plating machines) averages about one-tenth the allowable discharge to the public sewer, whereas plant 2 (2 plating machine) averages about one-fourth to one-half the mandated discharge limits. (See also W89-02392) (Lantz-PTT) (Lantz-PTT) W89-02400

HOWARD PLATING CLEAN UP THEIR ACT WITH MAGNESIUM HYDROXIDE, Howard Plating Industries, Madison Heights, MI. For primary bibliographic entry see Field 5D. W89-02401

WASTE WATER REDUCTION IN METAL FAB-RICATIONS OPERATIONS,

Du Pont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Plant. For primary bibliographic entry see Field 5D. W89-02405

ELECTROLYTIC RECOVERY THEORY, AP-PLICATION, ADVANTAGES, Baker Brothers/Systems, Stoughton, MA. For primary bibliographic entry see Field 5D. W89-02407

ENVIRONMENTAL AUDITING: MANAGE-MENT'S KEY TO EFFECTIVE ENVIRONMEN-TAL COMPLIANCE,

Mabbett, Capaccio and Associates, Inc., Cambridge, MA. For primary bibliographic entry see Field 6A. W89-02409

SUCCESSFUL IN HOUSE RECOVERY OF

Finish Engineering Co., Erie, PA.

Philips Engineering Co., Erie, FA.

D. T. Edinger.

IN: 8th AESF/EPA Conference on Pollution Control for the Metal Finishing Industry. EPA Report No. EPA/600/9-87/012, July 1987. p 285-289.

Descriptors: *Waste recovery, *Wastewater treatment, *Solvents, *Water pollution prevention, Distillation, Filtration, Waste disposal, Decorating industry, Coatings, Costs, Case studies, Degreasers.

True solvent reclamation is achieved by distillation, not just by mere filtering. Filtration alone may extend a solvent's life for a limited time, but filtration cannot extend its life indefinitely. Distillation can return cleaning solvents to their original performance by removing all contamination, both suspeaded and dissolved. Fractional distillation systems for breaking down solvents into their original components are expensive and not normal-paractical or necessary for reclaiming solvent for cleaning purposes. Solvent recovery using simple batch units readily available from several manufacturers. Equipment available for less than \$6,000 can recover about 15 gal/shift. Such operations typically require a half-hour of semi-skilled labor and use 7-10 cents of electricity/gallon processed. Case studies concerning degreasing solvents, coat-True solvent reclamation is achieved by distillaing solvents, and a silk screen cleaning operation. also W89-02392) (Lantz-PTT)

CALPURNIA AND THE STRIP BARN, Naval Air Rework Facility, Cherry Point, NC. For primary bibliographic entry see Field 5D. W89-02411

ANALYSIS OF AGRICULTURAL NONPOINT POLLUTION CONTROL OPTIONS IN THE ST. ALBANS BAY WATERSHED, Economic Research Service, Washington, DC. Natural Resource Economics Div. K. Frevert, and B. M. Crowder. Available from the National Technical Information Service, Springfield, VA. 22161, as PB87-214151. Price codes: A03 in paper copy, A01 in microfiche. Staff Report No. AGES870423.

Descriptors: *Water pollution control, *Lake Champlain, *Vermont, *St. Albans Bay, *Non-point pollution sources, *Agricultural runoff, Nu-trients, Computer models, Agricultural Nonpoint Source Pollution Model, Agriculture, Farm

The computer model, the Agricultural Nonpoint Source Pollution Model (AGNPS), was used to estimate nutrient losses both within the St. Albans Bay watershed, Vermont, at the field scale and at the watershed outlet. The capability of AGNPS to evaluate problem sites within a watershed can assist nonpoint pollution program administrators in the capability of AGNPS to the control of assist ionpoint pointion program auministrators trangeting beat management practices (BMPs). Findings included: improvements to barnyards, such as controlling runoff by diversion systems or sod buffer strips, reduced nitrogen (N) and phossod outler strips, reduced nitrogen (N) and phosphorus (P) concentrations at the watershed outlet by as much as 7%; implemented BMPs can cause substantial reductions in N, P, and chemical oxygen demand (COD) losses during storms; farms located along water channels near the watershed outlet had a larger impact on watershed water quality than inland farms; the initial levels of N and P losses have an important effect on relative abatequality than inland farms; the initial levels of N and P losses have an important effect on relative abatement costs and often are more significant in determining relative abatement costs than the type of manure storage structure selected; often the marginal cost of P loss abatement associated with agricultural BMPs may exceed the marginal abatement costs of removal from point sources; Long-term water quality improvements depend on the farmer as a nutrient manager; and this and similar models can be used for screening watersheds to determine which ones can attain water quality improvements by BMP implementation and where the BMP would be most effective. (Lantz-PTT) W89-02419

BIOLOGY OF THE YELLOW PERCH IN LAKE SHARPE, SOUTH DAKOTA, 1964-1975, Fish and Wildlife Service, Pierre, SD. North Cen-tral Reservoir Investigations. For primary bibliographic entry see Field 2H. W89-02428

FISCAL YEAR 1986 PROGRAM REPORT (NEW YORK WATER RESOURCES INSTI-

New York State Water Resources Research Inst., Ithaca. For primary bibliographic entry see Field 9D. W89-02471

METHODS FOR HYDROLOGIC MONITOR-ING OF SURFACE MINING IN THE CEN-TRAL-WESTERN UNITED STATES, Geological Survey, Denver, CO. Water Resources

For primary bibliographic entry see Field 7A. W89-02490

ADVISORY SYSTEM FOR NORTH CAROLINA GROUNDWATER QUALITY MODELING AND MANAGEMENT NEEDS, Duke Univ., Durham, NC. Dept. of Civil and

Environmental Engineering.
M. A. Medina, J. B. Butcher, and C. M. Marin. M. A. Medina, J. B. Butcher, and C. M. Marin. Available from the National Technical Information Service, Springfield, VA 22161 as PB88-235791/AS. Price codes: A11 in paper copy; A01 in microfiche. North Carolina Water Resources Research Institute, Raleigh, Completion Report No. 236, February 1988. 215p, 11 fig, 7 tab, 45 ref. State Project No. 87-17-70058.

Descriptors: *Groundwater management, *Computer models, *North Carolina, *Permits, Water quality, Groundwater pollution, Groundwater, Risks, Wastewater disposal permits, Computer programs, Decision making, Algorithms.

Federal policy states that groundwater quality management is a State responsibility. Waste disposal sites that discharge or may leak to a groundwater system must undergo a permitting process. Applications are reviewed by the Division of Environmental Management, Department of Natural Resources and Community Development, State of North Carolina. This project conditions the permitting process upon: sound mathematical modeling techniques, review of all sources of data on mitting process upon: sound mathematical modeling techniques, review of all sources of data on waste, method of disposal and hydrogeologic scenario - all processed by a computerized advisory system capable of assessing degree of uncertainty within a sequential decision analysis framework. The advisory system is a friendly, interactive menu-driven management program which executes a large number of supporting decision algorithes. a large number of supporting decision algorithms and mathematical models, including 3-dimensional and mathematical models, including 3-dimensional color graphics representation of the predicted contaminant plume. A user's manual is presented for the advisory system in general, and for each of the component models in particular, with example applications. Technical programming considerations are reviewed, including future code development and its incorporation. (Lambert-UNC-WRRI) W89-02548

CONSIDERATION OF DIMENSIONAL DE-PENDENCE IN MODELLING THE STRUC-TURE OF FLOW ZONES WITHIN THE SUB-Notre Dame Univ., IN. Dept. of Civil Engineer-

For primary bibliographic entry see Field 5B. W89-02551

WATER LEVEL MEASUREMENTS 1981-85
AND CHEMICAL ANALYSES 1978-85, RED
RIVER ALLUVIAL AQUIFER, RED RIVER
VALLEY, LOUISIANA,
Geological Survey, Alexandria, LA. Water Resources Div.

For primary bibliographic entry see Field 7C. W89-02582

GROUNDWATER PROTECTION BY ACCEL-ERATED TESTING OF ORGANIC CHEMICAL BREAKTHROUGHS OF SOIL BARRIERS, Connecticut Univ., Storrs. Dept. of Chemistry. For primary bibliographic entry see Field 5A. W89-02585

GROUND WATER QUALITY AND AGRICUL-TURAL PRACTICES.

For primary bibliographic entry see Field 3F. W89-02654

SOIL TESTING AS A GUIDE TO PRUDENT USE OF NITROGEN FERTILIZERS IN OKLA-HOMA AGRICULTURE, Oklahoma State Univ., Stillwater. For primary bibliographic entry see Field 7B. W89-02664

EFFICIENT NITROGEN FERTILIZATION IN AGRICULTURAL PRODUCTION SYSTEMS, Oklahoma State Univ., Stillwater. Dept. of Agron-

For primary bibliographic entry see Field 5B.

Water Quality Control—Group 5G

IMPACTS OF AGRICULTURAL CHEMICALS ON GROUND WATER QUALITY IN 10WA, Geological Survey, Iowa City, IA. For primary bibliographic entry see Field 5B. W89-02668

ASSESSING SOME POTENTIALS FOR CHANGING AGRONOMIC PRACTICES AND IMPROVING GROUND WATER QUALITY: IMPLICATIONS FROM A 1984 IOWA

IMPLICATIONS FROM
SURVEY,
Iowa State Univ., Ames.
S. Padgitt, and J. Kaap.
IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p
217-226, 1 fig. 4 tab, 11 ref.

Descriptors: *Water quality, *Groundwater *Agronomy, *Water pollution control, *Agriculture, *Fertilizers, *Iowa, Groundwater, Corn, Ni-

The implications of a 1984 Iowa survey concerning applications of fertilizer and the relationship to groundwater quality are discussed. Given the production increases farmers have experienced over the years with applications of nitrogen, immediate changes in fertilizer and produced the present of the produced of the duction increases farmers have experienced over the years with applications of nitrogen, immediate changes in fertilizer management by large numbers of farmers should not be expected. Personal interviews were conducted with 209 farmers during the summer, 1984, in Big Spring Basin, lowa. Farmers in the Big Spring Basin, on average, were applying 150 pounds of nitrogen per acre on third and succeeding years of corn. When these rates are aggregated across the number of acres in the different rotations, approximately 4,950,000 pounds of chemical fertilizer nitrogen was reported applied to corn acreage in the basin in 1984. The challenge to farmers has been to encourage changes in management practices that reduce the volume of nitrogen applied to the soils to a level more nearly coinciding with he nutrient needs of crops. A 1986 survey has updated the 1984 inventory. One third of the Big Spring farmers said they had reduced the rate of fertilizer applications since 1984. Demonstration plots have documented the potential for reducing nitrogen applications while maintaining current yield averages. Of 161 basin farmers responding, 66 percent indicated the nutrient value of manure was more than the costs to retrieve it. However, if 80 pounds of excess nitrogen is being rangied per corn acre then more than attention than attention. of manure was more than the costs to retrieve it.

However, if 80 pounds of excess nitrogen is being applied per corn acre, then more than attitudinal change is needed. But the attitudinal change in nitrogen application is a start in the right direction. (See also W89-02654) (Davis-PTT) W89-02669

REGULATION OF THE AGRICULTURAL UTI-LIZATION OF SEWAGE SLUDGE IN NEW

New Jersey Dept. of Environmental Protection, Trenton. Residuals Management Section. For primary bibliographic entry see Field 5E. W89-02676

INCENTIVES AND INSTITUTIONS TO REDUCE PESTICIDE CONTAMINATION OF GROUND WATER,
California Univ., Berkeley. Dept. of Agricultural and Resource Economics.
B. P. Baker.
IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p 345-355, 3 tab, 17 ref.

Descriptors: "Water pollution control, "Ground-water pollution, "Regulations, "Pesticides, "Agri-cultural chemicals, Economic aspects, Policy making, Political aspects, Political constraints, Legal aspects, Groundwater.

The institutions that are supposed to protect groundwater from agricultural pollution are critiqued; their weaknesses are pointed out. Alternative institutions for protecting groundwater from pollution are proposed. The tradeoffs between these institutions are evaluated. Farmers have polluted groundwater for centuries. The failure of the courts and the market to deal with water pollution

Group 5G-Water Quality Control

led to the passage of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500). The Culver Amendments directs the Secre-tary of Agriculture to establish and administer Best tary of Agriculture to establish and administer Best Management Practices for agricultural and silvicultural lands. Federal regulation of pesticides also was adopted in response to a different set of circumstances than groundwater contamination. The intention was to protect farmers, and later, consumers, but not the environment. Also pertinent to protecting groundwater from chemical contamination is the Safe Drinking Water Act. Congress intended to provide an incentive for small systems to combine into larger systems that would spread the cost of treatment over more consumers. All to combine into larger systems that would spread the cost of treatment over more consumers. All state governments have statutes; however, states vary widely in the power delegated to the districts. Local ordinances have a long history in protecting drinking water supply sources. Economists have long favored taxes and subsidies as a efficient means for dealing with externalities. If pesticide means for dealing with externatives. It pesticide contamination of groundwater is to be eliminated, farmers will need assistance in the form of subsidy payments for low-impact crops in the short-run, subsidized technical assistance over the medium-run, and, over the long-run, research for reduced input production techniques. (See also W89-02654) (Davis-PTT) W89-02677

POULTRY MANURE MANAGEMENT AND GROUND WATER QUALITY: THE DELA-WARE SOLUTION, Delaware Univ., Newark. Coll. of Agricultural

Sciences. J. R. Harris. IN: Ground Water Quality and Agricultural Prac-tices. Lewis Publishers, Chelsea, Michigan. 1987. p 357-365, 4 tab, 11 ref.

Descriptors: *Poultry, *Delaware, *Manure, *Water pollution prevention, *Groundwater pollution, Storage method, Leaching, Nitrogen.

The management of poultry manure, with respect to groundwater quality, in the state of Delaware was investigated. Most of Delaware lies within the coastal plain. The soils are alluvial deposits of sand coastal plain. The soils are alluvial deposits of sand and silts. The unconfined water table aquifer is the primary source of water for all domestic and agricultural uses. The potential for water soluble pollutants to leach into the groundwater is high. During 1982, a plan of action to address the major source of nitrate contamination to groundwater was finalized. The program became know as the MANURE Program (Managing Agricultural Nuteints Utilizing Resources Effectively). The program was targeted to the broiler industry of Delaware. The MANURE Project emphasized that with proper management, use, and storage, broiler manure could be eliminated as a source of pollution. Demonstrations on numerous farms compared inaudic could be eliminated as a source of point-tion. Demonstrations on numerous farms compared the use of broiler manure and commercial fertilizer in both no-till and conventional-till corn produc-tion. The results demonstrated that broiler manure could be used as a substitute for commercial fertil-izer without a net loss of profit. A poultry manure storage method was developed which keeps the manure dry, preventing runoff and leaching of nitrogen and other nutrients. A cost-share program nutroger and other nutrients. A cost-snare program brought these findings to the agricultural commu-nity. The farmers were obligated to calibrate their manure spreaders and develop and implement nu-trient management programs. From 1981 to 1986, there was a significant increase in the number of farmers who calibrated manure spreaders, used manure analysis, improved poultry manure storage, and increased the manure application rate. (See also W89-02654) (Davis-PTT)

NITROGEN AND GROUND WATER PROTEC-

TION. Agricultural Research Service, Durant, OK. S. J. Smith, J. W. Naney, and W. A. Berg. IN: Ground Water Quality and Agricultural Prac-tices. Lewis Publishers, Chelsea, Michigan. 1987. p 367-374, 2 fig. 2 tab, 12 ref.

Descriptors: *Water quality control, *Nitrogen, *Groundwater pollution, *Agriculture, *Fertiliz-

ers, Nitrate, Ammonium, Drainage, Wells, Soil properties.

The impact of agricultural practices on ground-water quality of the Southern Plains is assessed. The nitrate-N and ammonium-N results and recommendations for wells that are monitored periodically on watersheds in the Cross Timbers, Rolling Red Plains, and Rolling Red Prairies major land resource areas are presented. The results indicate that no major problems presently exist regarding nitrate and ammonium content in groundwater analyzed from a range of agricultural watersheds and settings. Because groundwater seepage tends to follow the same general direction as that of surface water, to the extent possible, agricultural field, feedlot, farmyard, and septic tank drains should be directed away from wells. In the case of feedlots nitrate problems may occur when they are not in use. Then the surface seal breaks down, conditions become more aerobic, and nitrate pro-The impact of agricultural practices on groundconditions become more aerobic, and nitrate pro-duction from the accumulated ammonium is initiatduction from the accumulated ammonium is initiatied. Also to be avoided around wells are the storage, mixing, and loading of N fertilizer. As a precautionary measure, periodic surveillance of the watershed wells in addition to occasional soil profile sampling, will be continued. (See also W89-02654) (Davis-PTT) W89-02679

GROUND WATER AND AGRICULTURE: ADDRESSING THE INFORMATION NEEDS OF PENNSYLVANIA'S CHESAPEAKE BAY PRO-

Pennsylvania State Univ., University Park. Dept.

rennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
J. R. Makuch, and M. D. Woodward.
IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p
375-388, 3 fig. 1 tab, 11 ref.

Descriptors: *Water quality control, *Education, *Fertilizers. *Groundwater, *Pennsylvania, *Fertilizers, *Groundwater, *Pennsylvania, *Chesapeake Bay, *Agriculture, Susquehanna

The Commonwealth of Pennsylvania's Chesapeake Bay Program is discussed with respect to: the educational component, the promotional campaign, the demonstration projects, the water quality program, and information delivery methods. The intention of the program is to improve water quality in the Chesapeake Bay and the Susquehan-Biver Basin by reducing agricultural nonnoint. quality in the Chesapeake Bay and the Susquehan-na River Basin by reducing agricultural nonpoint source pollution. The program is administered by the State Conservation Commission through the Pennsylvania Department of Environmental Re-Pennsylvania Department of Environmental Resources. Twenty percent of the funds is used to support educational efforts. The purpose of the promotional campaign is to inform the agricultural community about the program and to encourage adoption of best Management Practices by farmers in southeastern Pennsylvania. Demonstration projects are designed to show farmers actual examples of ways to manage soil resources and nutrients in a manner which both environmentally and economically sound. A variety of media are used to disseminate information on groundwater and drinking water quality. All materials are geared towards a popular, nontechnically oriented auditowards a popular, nontechnically oriented audience. Nutrient runoff from agricultural land in southeastern Pennsylvania has been implicated as one of the factors contributing to ecological perturbations in the Chesapeake Bay. With a strong inter-agency and intra-agency cooperation the edu-cation component can be an effective tool in helping to improve the water quality in Pennsylvania and in the Chesapeake Bay. (See also W89-02654) (Davis-PTT) 89-02680

CONSEQUENCES OF DREDGING, Virginia Inst. of Marine Science, Gloucester Point. For primary bibliographic entry see Field 2L.

NORTH ALABAMA WATER QUALITY AS-SESSMENT, VOLUME VIII - WATER QUAL-ITY MODELING, Tennessee Valley Authority, Norris. Engineering

For primary bibliographic entry see Field 5B. W89-02702

WASTEWATER CHARACTERIZATION AND HAZARDOUS WASTE SURVEY, CASTLE AFB, CA,

Air Force Occupational and Environmental Health Lab., Brooks AFB, TX. For primary bibliographic entry see Field 5D. W89-02704

SUPERFUND RECORD OF DECISION: COMBE FILL NORTH LANDFILL, NJ. Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response. Available from the National Technical Information Service, Springfield, VA. 22161, as PB87-188488. Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA/RO2-86/028, September 1986. 77p, 7 fig, 6 tab.

Descriptors: *Water pollution treatment, *Ground-water pollution, *Combe Fill North, *Landfills, New Jersey, Pollutant identification, Volatile or-ganics, Hexachlorobenzene, Phenols, Ethyl phthal-ate, Waste management, Drainage systems, Clean-up operations, Ventilation, Methane, Costs, Organ-

The Combe Fill North site is located in Mount Olive Township, NJ, near the intersection of U.S. Highway 206 and Interstate 80. The former landfill Olive Lowinship, NJ, near the intersection of U.S. Highway 206 and Interstate 80. The former landfill comprises 65 acres of the 103-acre property. The area surrounding the site is primarily wooded, with small residential areas, farms and light industry nearby. Approximately 10,000 people rely on groundwater supplied from wells downgradient of the site. Between 1966 and 1978, the site operated as a sanitary municipal landfill, accepting municipal, vegetative, and non-chemical industrial wastes, along with small amounts of dry sewage sludge. In 1979, public outrage at the disposal practices of Combe Fill Corporation (CFC) led to formation of a public action group that conducted groundwater sampling and initiated procedures to include the Combe Fill North site on the National Priorities List. During the Remedial Investigation, groundwater, soils, leachate, sediments, and surface water were sampled. Low levels of volatile organics were found in soils and leachate, and hexachlorobenzene, phenol and bis (2-ethylhexyl) phthalate were detected in low concentrations in groundwaters. benzene, phenol and bis (2-ethylhexyl) phthalate were detected in low concentrations in groundwater samples. The selected remedial action for the Combe Fill North site includes: grading and compacting the 65-acre waste disposal area; capping the landfill in accordance with appropriate solid waste management criteria; installation of a drain-age system, including perimeter ditches and corrugated metal pipes; installation of a methane ventilation system; fencing the entire site; and implementation of an appropriate monitoring program to ensure the effectiveness of the remedial action. Estimated capital cost for the remedy is \$10,500,000 with annual operations and maintenance costs of \$168,000. (Author's abstract) W89-02707

EMERGING ISSUES IN SURFACE WATER QUALITY RESEARCH,

Geological Survey, Denver, CO. E. D. Andrews, and B. W. Webb.

IN: Hydrology 2000. International Association of Hydrological Sciences, Inst. of Hydrology, Wal-lingford, England. IAHS Publication No. 171, 1987. p 27-33.

Descriptors: *Water quality, *Surface water, Research priorities, Water pollution control, Water pollution sources, Agriculture, Water supply, Potable water, Groundwater, Future planning.

Water quality research, as measured by the growing numbers of researchers, increasing financial support, and proliferation of journal articles, is expanding rapidly, perhaps more rapidly than any other aspect of hydrology. Much of this growth has been directed toward ensuring an adequate supply of suitable water for human consumption,

Water Quality Control—Group 5G

and to a lesser extent for industrial and agricultural uses. No doubt this emphasis will continue in the future. Compared to river inflow and the direct discharge of municipal and industrial wastes in the Great Lakes, atmospheric deposition and groundwater inflow are more difficult to measure, less well understood, and more difficult to study. This well understood, and more difficult to study. In appear considers the expanding scope of water quality research, and speculates on how this research will develop during the next several years (1987-2000). (See W89-02717) (Lantz-PTT)

WATER ANALYSIS: A PRACTICAL GUIDE TO PHYSICO-CHEMICAL, CHEMICAL AND MI-CROBIOLOGICAL WATER EXAMINATION AND QUALITY ASSURANCE, For primary bibliographic entry see Field 7B. W89-02771

SUPERFUND RECORD OF DECISION: DISTLER FARM, KY. DISTILER FARM, KY.
Environmental Protection Agency, Washington,
DC. Office of Emergency and Remedial Response.
Available from the National Technical Information
Service, Springfield, VA. 22161, as PB87-190088.
Price codes: A03 in paper copy, A01 in microfiche.
EPA Report No. EPA/ROD/R04-86/011, August
1986. 29p, 3 fig, 4 tab.

Descriptors: "Hazardous wastes, "Waste disposal, "Toxic wastes, "Distler Farm, "Superfund, "Clean-up operations, "Kentucky, Water pollution treatment, Path of pollutants, Costs, Volatile organics, Organic compounds, Ketone, Toluene, Inorganic compounds, Radioactive wastes, Metals, Excavation, Landfills, Hazardous wastes, Waste disposal.

Distler Farm is located in the southwest corner of Distler Farm is located in the southwest corner of Jefferson County, KY, approximately one mile northwest of West Point, KY. The site is a 3 acre area approximately 1,000 feet from the Ohio River. The site was discovered in early 1977 during the development of an enforcement case against Mr. Donald F. Distler, owner of Kentucky Liquid Recycling, Inc. In an effort to locate sites that Mr. Distler may have used for chemical waste storage or disposal, EPA personnel inspected the site in Anril 1977. They reported approximately 600 or disposal, EPA personnel inspected the site in April 1977. They reported approximately 600 drums of industrial waste stored on the ground surface. In December 1978 the Ohio River and its tributaries flooded, causing drums of industrial wastes from the site to be scattered along the floodplain of the creek. During the cleanup effort U.S. Army personnel located four drum burial sites. Between January 1979 and April 1984, the EPA conducted various surface water, groundwater, soil, sediment, and well studies. These studies confirmed the evidence of soil contamination and groundwater contamination and the site. No significant site-related contamination appread in surface groundwater contamination at the site. No significant site-related contamination appeared in surface waters, sediments or residential wells outside the property boundaries. The primary contaminants of concern include: volatile organic compounds, perchloroethylene, trichloroethylene, ketones, toluene, inorganics, radioactive material, and metals. The selected remedial action includes: excavation and removal of all contaminated soils and offsite disposal in a hazardous waste landfill; backfill with 'clean' natural granular soils, extraction of contaminated groundwater and temporary accumulation and onsite storage; transportation of contaminated groundwater to offsite commercial facility and treatment to background levels; reinjection of and treatment to background levels; reinjection of uncontaminated water into the aquifer; maintenance of vegetation, erosion repair, and ground-water monitoring for a one year period. The capital cost is \$11,130,400 with operations and maintenance in years 1-10 of \$113,600 and \$20,000 for years 11-130. (Lantz-PTT)

PRETREATMENT IN CHEMICAL WATER AND WASTEWATER TREATMENT. Proceedings of the Third Gothenburg Symposium 1988, 1-3 June 1988, Gothenburg, Springer-Verlag, New York. 1988. 356p. Edited by Herman H. Hahn and Rudolf Klute.

Descriptors: *Water treatment, *Wastewater treatment, *Pretreatment of water, *Chemical treat-

ment, *Industrial wastewater, Water pollution control, Economic aspects, Regulations, Water supply, Sludge, Control systems.

Pretreatment is the sum total of all measures taken Pretreatment is the sum total of all measures taken at the pollutant source to protect water supply, the sewerage system, the central treatment plant, and the aqueous environment. It is, where applicable, the most efficient measure in ecological and economic respects. The twenty-nine contributions of this third symposium address questions of surveil-lance, automation, and remote control of installations as well as the principles of legal, administrative and economic resource for equations with tions as well as the principles of legal, administra-tive, and economic measures for regulations within the context of pretreatment. Special attention is given to the possibilities and limits of pretreatment of industrial discharges. The volume is divided into three sections which deal in turn with water surce sections which deal in turn with water supply, industrial discharges, and wastewater and sludge. (See W89-02792 thru W89-02820) (Shidler-PTT) W89-02791

WATER QUALITY PROBLEMS AND CON-TROL STRATEGIES FOR THE WATER SUPPLY OF TIANJIN CITY, Tianjin Inst. of Environmental Protection and Sciences (China).

For primary bibliographic entry see Field 5F. W89-02794

ODOUR CONTROL BY ARTIFICIAL GROUNDWATER RECHARGE, Linkoeping Univ. (Sweden). Dept. of Water in Environment and Society.
For primary bibliographic entry see Field 5F. W89-02799

CLEAN TECHNOLOGY IN THE NETHER-LANDS: THE ROLE OF THE GOVERNMENT.

LANDS: THE ROLE OF THE GOVERNMENT, Rijksinstituut voor Zuivering van Afvalwater, Lelystad (Netherlands).
A. B. van Luin, and W. van Starkenburg.
IN: Pretreatment in Chemical Water and
Wastewater Treatment. Springer-Verlag, New
York. 1988. p 139-149, 2 fig. 3 tab, 10 ref.

Descriptors: *Water quality control, *Wastewater treatment, *The Netherlands, *Public policy, *Technology, *Water pollution control, Industrial wastewater, Cadmium, Chromium, Technology transfer, Heavy metals, Pesticides.

transfer, Heavy metals, Pesticides.

Curbing the pollution of surface waters remains the primary objective of water-pollution control in the Netherlands. The Dutch Government wants to achieve this goal by stimulating, among other things, the development of clean technology. A number of projects involving clean technology and iscussed, such as electrochemical treatment of process wastewater containing halogenated organic compounds, substitution for cadmium in the metal-plating industry, the development of clean-technology phosphate-fertilizer production processes, reduction in chromium discharge from the leather industry, and measures to improve fish-processing techniques. The government intends to promote clean technology so that environmental requirements may be accommodated and an equilibrium be developed between the forces of supply and demand. Although it will continue to participate in a range of research and demonstration projects, the government also intends to play a more active role in this area. Thus it has recently initiated a multi-year research program of its own. more active role in this area. Thus it has recently initiated a multi-year research program of its own. It is especially important that the transfer of information about clean technologies be intensified. Other main objectives of the research program are to improve treatment technologies and to curb the use of substances that have a detrimental effect on the environment, such as heavy metals and pesticides. (See also W89-02791) (Author's abstract) W89-02801

TREATMENT OF FILTER EFFLUENTS FROM DEWATERING OF SLUDGES BY A NEW HIGH PERFORMANCE FLOCCULATION RE-

ACTOR, Technische Univ. Berlin (Germany, F.R.). Inst.

fuer Chemieingenieurtechnik. For primary bibliographic entry see Field 5D. W89-02819

EFFECTS OF AERATION AND MINIMUM FLOW ENHANCEMENT ON THE BIOTA OF NORRIS TAILWATER,

NORRIS TAILWATER,
Tennessee Valley Authority, Norris. Office of Natural Resources.
B. L. Yeager, W. M. Seawell, C. M. Alexander, D. M. Hill, and R. Wallus.
Available from the National Technical Information Service, Springfield, VA 22161, as DE88-900175.
Price codes: A04 in paper copy, A01 in microfiche. Report No. TVA/ONRED/AWR-87/41, January 1987. 90p, 12 fig, 27 tab, 23 ref, append.

Descriptors: *Aeration, *Water quality control, *Ecological effects, *Dissolved oxygen, *Hydroelectric powerplants, *Clinch River, *Norris Dam, Environmental effects, Trout, Seasonal variation,

Two major problems historically associated with reservoir releases in the United States have been the discharge of water containing low dissolved oxygen concentrations (DO) during periods of hydroelectric generation and inadequate minimum flows when the turbines were idle. Both conditions droelectric generation and inadequate minimum flows when the turbines were idle. Both conditions have adverse effects on aquatic life in streams, and taken together are a major impediment to development of a top-quality fishery in many tailwaters. In the Clinch River in east Tennessee, releases from Norris Dam have had DO concentrations as low as 1 mg/L, and for about 50 years there were no provisions for a minimum flow other than the small amount of leakage through the dam. To correct these conditions, TVA launched a Reservoir Releases Improvement Program in 1980 to increase DO during the warmer months of the year and to provide a minimum flow in the Norris Dam tailwaters. Turbine venting increased minimum Do in the releases by 0.7 mg/L in 1981 and 2-3 mg/L in 1982-85. A flow reregulation weir was installed in 1984 two miles below Norris Dam and provides a minimum flow of 200 cfs downstream. In addition to these efforts, increased numbers of catchable trout were stocked in the tailwater, access was improved, and publicity was increased. While aeration has improved the condition (plumpness) of trout during late summer and fall, the fish continue to show some effects of stress when DO levels fall below 6 mg/L. This seasonal drop in condition is not sufficient to affect significantly the value of the fish from the angler's standpoint, and varies considerably from year to year depending on flow conditions in the tailwater. No major value of the fish from the angler's standpoint, and varies considerably from year to year depending on flow conditions in the tailwater. No major changes were observed in invertebrates in the tailwater during turbine aeration alone; however, in 1985, with both aeration and increased minimum flow, desirable forms became more widespread and frequent in the stream. (Lantz-PTT) W89-02826

INTENSIVE SURVEY OF THE DUPAGE RIVER BASIN, 1983.

Illinois State Environmental Protection Agency. Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-188594. Price codes: A04 in paper copy, A01 in microfiche. Illinois EPA Report No. IEPA/WPC/88-010, Jan-uary 1988. 61p, 3 fig. 15 tab, 13 ref, 3 append.

Descriptors: *Illinois, *Limnology, *Water quality, *DuPage River, Ecosystems, Coliforms, Iron, Rivers, Sediments, Classification, Metals, Hydro-

A cooperative survey of the aquatic resources of the DuPage River basin was conducted in 1983 by the Illinois Environmental Protection Agency and the Illinois Department of Conservation. Fish, macroinvertebrate, water, sediment, and habitat data were collected as part of the survey. Twenty-one stations were established within the West Branch of the DuPage River, East Branch of the DuPage River, East Branch of the DuPage River. Environmental quality was summarized utilizing various indices, including the Water

Group 5G-Water Quality Control

Quality Index (WQI), Macroinvertebrate Biotic Index (MBI), Index of Biotic Integrity (AIBI) and, to a limited extent, habitat (PIBI). Mean (+ or - SD) index values were 57.3 (+ or - 14.5) WQI, 6.1 (+ or -0.6) MBI, 28 (+ or -6) AIBI, and 40 (+ or -5) PIBI. Individual stations were evaluated for degree of aquatic life use support and classified according to the biological stream classification (BSC) system used for rating Illinois streams. Of the twenty-one stations sampled, eight (38%) had a BSC rating of C and thirteen (62%) were rated as D streams. Concentrations of fecal coliform and total iron in excess of the water quality standards D streams. Concentrations of fecal coliform and total iron in excess of the water quality standards were common within the DuPage basin with maximum subbasin violation rates of 71.8% and 75%, respectively. DuPage sediment samples had consistently elevated concentrations of metals and organochlorine compounds and ranked high among eight northern Illinois river basins evaluated for sediment contamination. (Author's abstract) W89-02829

SUPPLEMENTAL FINAL DEVELOPMENT DOCUMENT FOR EFFLUENT LIMITATIONS GUIDELINES, NEW SOURCE PERFORM-ANCE STANDARDS AND PRETREATMENT STANDARDS FOR THE LEATHER TANNING AND FINISHING POINT SOURCE CATEGO-

Environmental Protection Agency, Washington, DC. Industrial Technology Div. For primary bibliographic entry see Field 6E. W89-02832

MANAGING FARM NUTRIENTS: TRADEOFFS FOR SURFACE AND GROUND-WATER QUALITY, Economic Research Service, Washington, DC. Re-

Economic Research Service, washington, D.C. Resources and Technology Div.

B. Crowder, and C. E. Young.

Available from the National Technical Information Service, Springfield, VA 22161, as PB88-168661.

Price codes: A03 in paper copy, A01 in microfiche. Agricultural Economic Report No. 583, January 1988. 22p, 5 tab, 34 ref.

Descriptors: *Nutrients, *Agricultural runoff, *Groundwater quality, *Water quality control, Water pollution prevention, Farming, Soil conservation, Nitrates, Leaching, Simulation analysis, Model studies, Economic aspects.

Comprehensive soil and nutrient management on the farm can reduce water pollution. Matching the amount and timing of nutrient applications to the needs of crops is the most cost-effective and efficient way to control nutrient contamination of surface and groundwater. Soil conservation practices reduce surface-water pollution, but can in-crease nitrate leaching through the soil. Misdirected practices, such as excessive or mistimed manure applications, can increase nutrient contamination of surface and groundwater. A field-scale computer simulation model, CREAMS (Chemicals, Runoff, and Erosion from Agricultural Management Systems) was used to assess pollutant losses from agricultural land to water. A central theme of the analysis is the tradeoff between nutrient loadings in surface water versus groundwater. (Author's abstract) ed practices, such as excessive or mistimed manure thor's abstract) W89-02833

LAKE ERIE CONSERVATION TILLAGE DEM-ONSTRATION PROJECTS: EVALUATING MANAGEMENT OF PESTICIDES, FERTILIZ-ER, RESIDUE TO IMPROVE WATER QUAL-ITY.

Environmental Protection Agency, Chicago, IL. Great Lakes National Program Office. For primary bibliographic entry see Field 3F. W89-02837

INTENSIVE SURVEY OF THE FOX RIVER BASIN FROM THE WISCONSIN STATE LINE TO OTTAWA, ILLINOIS: 1982. Illinois State Environmental Protection Agency,

Springfield. Div. of Water Pollution Control.

Available from the National Technical Information
Service, Springfield, VA 22161, as PB88-188586.

Price codes: A06 in paper copy, A01 in microfiche. Report No. IEPA/WPC/88-003, December 1987. 107p, 1 fig, 7 tab, 9 ref, 6 append.

Descriptors: *Fox River, *Water quality, *Limnology, *Illinois, Monitoring, Water quality control, Chemical analysis, Fish, Macroinvertebrates, Ecosystems, Biological studies, Sediments, Water sampling.

A survey of the Fox River was accomplished during 1982 by the Illinois Environmental Protection Agency and the Illinois Department of Conservation. Sampling was accomplished at 23 tributary stations for water quality (seasonal), habitat, sediment chemistry, macroinvertebrates and fish. Stations were established on the major tributaries of the Fox River including the N. Branch Nippersink, Nippersink (2), Boone, Flint, Tyler, Poplar, Ferson, Mill (2), Waubansee, Blackberry (2), Big Rock (2), Little Rock, Somonauk (2), Little Indian, India (3), and Buck Creeks. Habitat, sediment chemistry, macroinvertebrate, and fish samples were collected in August 1982 and water sampling extended from May 1982 to February 1983. From these data, environmental quality was summarized these data, environmental quality was summarized utilizing various indices including water quality (WQI), macroinvertebrates (MBI), fish (IBI), and (WQI), macroinvertebrates (MBI), fish (IBI), and habitat (PIBI). Individual stations were evaluated for degree of support of aquatic life and classified according to the biological stream classification system used for Illinois streams. (Author's abstract) W89-02841

NATIONAL SURFACE WATER SURVEY: NA-TIONAL STREAM SURVEY PHASE I - PILOT

Utah Water Research Lab., Logan. J. J. Messer, C. W. Ariss, R. Baker, S. K. Drouse, and K. N. Eshleman.

and k. N. Estheman. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-170840. Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA/600/4-86/026, December 1986. 179p, 33 fig, 22 tab, 91 ref, 4 append. EPA Contracts 68-03-3050, 68-02-3889, 68-03-3246, and 40-1557-85. DOE Contract DE-AC05-84OR21400.

Descriptors: *Water quality, *Surface waters, *Surveys, *Network design, Data acquisition, Acidic waters, Streams, Water sampling, Monitor-ing, Hydrogen ion concentration, Statistical analy-

A pilot survey of streams in the Southern Blue Ridge Province was conducted by the U.S. EPA during the spring and summer of 1985 as a means of testing a proposed methodology for: (1) determining the present extent and location of acidic and low acid neutralizing capacity (ANC) streams in the United States, and (2) classifying sampled streams that are representative of important classes of streams and, therefore, should be selected for intensive study or long-term monitoring. Data from the National Stream Survey Phase I-Pilot from the National Stream Survey Phase I-Pilot Survey are presented in the context of evaluating a statistical sampling design, logistics plan, quality assurance plan, and data management program. Results indicate that the design is capable of pro-ducing robust population estimates for important chemical variables using a single synoptic sampling of streams, and that is has the potential of producing a relatively simple geochemical classification of streams. The study showed that, with 95% confidence, < 3.2% of the combined length of streams dence, < 3.2% of the combined length of streams in the target population exhibited average spring non-episodic pH values below 6.4 (the lowest value for which a confidence level could be used). The best estimate of the percentage of stream length with ANC < or = to 200 microeq/L was 74.4%. (Author's abstract) W89-02842

CORRECTIVE MEASURES FOR RELEASES TO GROUNDWATER FROM SOLID WASTE MANAGEMENT UNITS, GCA Corp., Bedford, MA. GCA Technology

M. M. Gosse, L. L. Farrell, N. Prominski, M. Arienti, and D. Dwight.
Available from the National Technical Information

Service, Springfield, VA 22161, as PB88-185251. Price codes: A06 in paper copy, A01 in microfiche. Report No. GCA-TR-85-69-G, August 1985. 161p. 17 fig. 24 tab, 55 ref, append. EPA Contract 68-01-

Descriptors: *Water pollution control, *Ground-water quality, *Solid wastes, *Waste management, Waste storage, Waste disposal, Geohydrology.

The Hazardous and Solid Waste Act of 1984 re-quires corrective measures for all releases of haz-ardous waste or hazardous constituents from any ardous waste or nazardous constituents from any solid waste management unit at a treatment, stor-age or disposal facility seeking a Resources Con-servation and Recovery Act permit, regardless of the time at which waste was placed in such unit. Groundwater control/treatment technologies in-Groundwater control/treatment technologies in-cluding grout systems, steel sheet piles, well sys-tems, subsurface drains, crushed limestone treat-ment, activated carbon treatment, and glauconitic treatment, were assessed. Bioreclamation tech-niques are also described. A series of case studies is included to demonstrate how to select and implement corrective measures for releases to ground-water from solid waste management units. (Lantz-PTT) W89-02844

ASSIMILATIVE CAPABILITIES OF RETENTION PONDS,

Geological Survey, Tallahassee, FL. For primary bibliographic entry see Field 5D. W89-02856

INTENSIVE SURVEY OF THE KISHWAUKEE RIVER AND ITS TRIBUTARIES, 1983.

Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control. For primary bibliographic entry see Field 5C. W89-02858

AMBIENT WATER QUALITY CRITERIA FOR CHLORIDE - 1988, Environmental Research Lab., Duluth, MN.

Available from the National Technical Information Service, Springfield, VA. 22161, as PB88-175047. Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA 440/5-88-001, February 1988. 39p, 5 tab, 108 ref.

Descriptors: *Water pollution control, *Chlorides, *Water quality standards, *Water pollution effects, Standards, Sodium chloride, Water quality, Fat-head minnows, Environmental effects, Daphnia, Mortality, Potassium chloride, Magnesium chlo-ride, Invertebrates, Toxicity.

The available aquatic toxicity data are reviewed for sodium chloride as well as several other chloride salts. Data is used to derive a criterion designed to protect against the toxic effects of sodium chloride, but may not be adequate for other salts because of their greater toxicity. Although few data are available concerning the toxicity of any chloride salt other than sodium chloride, the data that are available indicate that when com-pared on the basis of mg of chloride/L, the chlor-ides of potassium, calcium, and magnesium are generally more toxic to freshwater species than sodium chloride. Based on tests on sodium chlosodium chloride. Based on tests on sodium chloride, the acute sensitivities of freshwater animals to chloride ranged from 1.470 mg/L for Daphnia pulex to 11.940 mg/L for the American eel. Invertebrate species were generally more sensitive than vertebrates. No relationships have been observed between the acute toxicity of chloride to freshwater to the control of th between the acute toxicity of chloride to freshwater animals and hardness, alkalinity, pH, or life-stage of the test organisms. A life-cycle test with Daphnia pulex and early life-stage tests with the rainbow trout and fathead minnow produced chronic values of 372.1, 922.7, and 433.1 mg/L, respectively. The acute-chronic ratios were calculated to be 3.951 for Daphnia pulex, 7.308 for rainbow trout, and 15.17 for the fathead minnow. Freshwater plants were affected at concentrations of chloride ranging from 71 to 36.400 mg/L. (Lantz-PTT) W89-02860

LAKE MICHIGAN WATER QUALITY REPORT JANUARY THROUGH DECEMBER, 1986. Chicago Dept. of Water, IL. Water Quality Surveillance Section. For primary bibliographic entry see Field 5B. W89-02867

EVALUATION OF MUNICIPAL SO WASTE LANDFILL COVER DESIGNS, Battelle Columbus Div., OH. For primary bibliographic entry see Field 5E. W89-02871 SOLID

LITERATURE STUDY ON THE FEASIBILITY OF MICROBIOLOGICAL DECONTAMINATION OF POLLUTED SOILS,

TION OF POLLUTED SOILS, Hoofdgroep Maatschappelijke Technologie TNO, Delft (Netherlands). A. O. Hanstveit, W. J. T. van Gemert, D. B. Janssen, W. H. Rulkens, and H. J. van Veen. IB bitreatment Systems. Vol. 1. CRC Press, Boca Raton, Florida. 1988. p 63-155, 35 fig. 23 tab, 152 ref, 4 append.

Descriptors: *Soil contamination, *Oil wastes, *Water pollution prevention, *Water pollution treatment, *Hydrocarbons, *Aliphatic hydrocarbons, *Aromatic compounds, *Petroleum products, *Pesticides, *Halogenated pesticides, *Decontamination, *Biodegradation, Groundwater pollution, Microbial degradation, Fate of pollutants, Bacteria, Netherlands.

The microbial decontamination of soil polluted by organic chemicals in the Netherlands was investiorganic chemicals in the Netherlands was investigated. The following subjects are covered: the frequency of soil contamination and the nature of the contaminants (halogenated hydrocarbons, petroleum products, aromatic hydrocarbons, aliphatic compounds, pesticides), the biodegradability of contaminants, soil decontaminating procedures, and methods of protecting the environment against pollution from a contaminated area or from the decontamination procedures. (See also W89-02914) (Sand-PTT) W89-02916

IN SITU BIOLOGICAL TREATMENT OF HAZ-ARDOUS WASTE-CONTAMINATED SOILS, Utah State Univ., Logan. Dept. of Civil and Envi-ronmental Engineering. For primary bibliographic entry see Field 5D. W89-02923

SUPERFUND RECORD OF DECISION: NORTHERN ENGRAVING, WI.
Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response. For primary bibliographic entry see Field 5B. W89-02938 OF DECISION:

WATER QUALITY ASSESSMENT OF DOD IN-STALLATIONS/FACILITIES IN THE CHESA-PEAKE BAY REGION, PHASE III REPORT. VOLUME 1 - SUMMARY. Tetra Tech, Inc., Arlington, VA. For primary bibliographic entry see Field 5C. W89-02953

WATER QUALITY ASSESSMENT OF DOD IN-STALLATIONS/FACILITIES IN THE CHESA-PEAKE BAY REGION, PHASE III REPORT. VOLUME 2 - OVERALL APPROACH, FIND-INGS AND RECOMMENDATIONS. Tetra Tech, Inc., Arlington, VA. For primary bibliographic entry see Field 5C. W89-02954

TREATMENT OF OIL AND OILY WASTES, Norges Tekniske Hoegskole, Trondheim. Selskapet for Industriell og Teknisk Forskning.

G. Halmoe.

Available from the National Technical Information

Service, Springfield, VA 22161, as PB88-183280. Price codes: E04 in paper copy, E04 in microfiche. Report No. STF21 A8/7117, December 8, 1987. 28p, 3 fig, 10 tab, 11 ref.

Descriptors: *Waste treatment, *Oil wastes, *Norway, *Oil pollution, Cleanup operations, Incineration, Model studies, Bleaches.

The possibilities of a variety of methods available for the treatment of oily wastes, and their limitations, are evaluated based on the experience gained at SINTEF from disposal studies. The evaluations at SINTEF from disposal studies. The evaluations are closely related to Norwegian conditions, particularly with regard to shoreline types, accessibility for cleanup, and limited possibilities for incineration or recovery. Some examples are also given in the form of short summaries of the main experiments that have been carried out by SINTEF. These include laboratory scale, model studies and full-scale experiments. For complete descriptions of the experimental parameters and results, references are given to the original reports. (Lantz-PTT) W89-02963

OIL SPILL COMBAT IN THE ARCTIC - AN ALTERNATIVE APPROACH,
Norges Tekniske Hoegskole, Trondheim. Selskapet for Industriell og Teknisk Forskning.

tor industriet og Feknisk Forskning.
P. Sveum.
Available from the National Technical Information
Service, Springfield, VA 22161, as PB88-182472.
Price codes: E04 in paper copy, E04 in microfiche.
Report No. STF21-A87106, December 29, 1987. 24p, 7 fig, 1 tab, 15 ref.

Descriptors: *Cold regions, *Oil spills, *Arctic zone, *Cleanup operations, *Water pollution treat-ment, Risks, Model studies, Oil pollution, Polar

The feasibility of establishing a low cost oil spill strategy for cold regions is evaluated. The risk connected with the particular type of strategy should not be greater than employing conventional strategies and if any alternative countermeasures are involved, the countermeasure should not involve more risk than the oil represents. Natural processes that affect the fate of oil include evaporation, dispersion, dissolution, emulsification, photogradation, and biodegradation. Research has processes that affect the fate of oil include evaporation, dispersion, dissolution, emulsification, photoxidation, and biodegradation. Research has been conducted on these processes in artic and subarctic environments, specifically on oil in seaweed, in mud flat sediments, and in gravel shores. A risk index model, which is in its preliminary stage, is being developed. The probability of persistence is the prime component of the risk index. The probability of causing harm is also incorporated in the bility of causing harm is also incorporated in the model. (Lantz-PTT) W89-02966

SUPERFUND RECORD OF DECISION: KANE AND LOMBARD, MD.

Environmental Protection Agency, Washington DC. Office of Emergency and Remedial Response For primary bibliographic entry see Field 5E. W89-02977

SUPERFUND RECORD OF DECISION: KA-TONAH MUNICIPAL WELL, NY.

Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response. Available from the National Technical Information Available from the National Technical miornation Service, Springfield, VA 22161, as PB88-185756. Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA/ROD/R02-87/047, September 1987. 41p., 9 fig., 2 tab.

Descriptors: *Superfund, *Water pollution treatment, *Cleanup operations, *Water pollution sources, Bedford, New York, Tetrachloroethylene, Volatile organic compounds, Wells, Groundwater pollution, Costs.

The Katonah Municipal Well site is located in the Village of Katonah in the Town of Bedford, West-chester County, New York. The well is situated on a peninsula owned by the City of New York that extends into the Muscoot Reservoir. In 1978 the

Water Quality Control—Group 5G

Westchester County Department of Health (WCDH), acting on Putnam County Health Department findings, sampled the Katonah well and other local wells for contamination. These samples revealed the presence of tetrachloroethylene (TCE) and other VOCs in the well water. These contaminants were traced to a local septic wate collector who was disposing of wastes taken from several Katonah dry cleaning establishments. In 1978 the Katonah well was closed and source control measures were initiated requiring dry cleaning establishments to pump out their septic systems and modify solvent disposal techniques. Initial attempts by WCDH and the Town of Bedford to remove contaminant of concern affecting the groundwater is PCE. The selected remedial action for this site includes: installation of a new production well adjacent to the abandoned well; filling and sealing of the abandoned Katonah well; installation and operation of an onsite air stripping facility to remove PCE and other volatiles from the aquifer with discharge of treated water to the Bedford Consolidated Water District distributor system; establishment of a monitoring program to detect residual contamination of treated water; and recommendations to the Town of Bedford to remove trash and debris located on the program to detect residual contamination of treat-ed water; and recommendations to the Town of Bedford to remove trash and debris located on the peninsula. The estimated capital cost for this reme-dial action is \$1,365,000 with annual operation and maintenance of \$296,000. (Author's abstract)

SUPERFUND RECORD OF DECISION: INDE-PENDENT NAIL, SC.

PENDENT NAIL, SC. Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-185749. Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA/ROD/R04-87/030, September 1987. 32p, 5 fig, 4 tab.

Descriptors: *Superfund, *Water pollution treatment, *Water pollution sources, Beaufort, South Carolina, Phosphates, Cyanide, Chromium, Cadmium, Lead, Mercury, Nickel, Zinc, Copper, Iron, Heavy metals, Wastewater Iagoons, Soil contamination, Path of pollutants, Cleanup operations.

The Independent Nail Company site, occupying 24.6 acres, is located near Beaufort, South Carolina. Land use in the vicinity of the site is a combination of fields, woodlands and wetlands. Endander Enda na. Land use in the vicinity of the site is a combination of fields, woodlands and wetlands. Endangered and threatened species may occur within the
area of influence of the site, although habitation
has not been confirmed. The previous owners of
the site, the Blake and Johnson Company, manufactured metallic screws and fasteners. As part of
the manufacturing process, the company discharged approximately 33,000 gpd of plating
wastewater into an unlined infiltration lagoon. The
lagoon was in use from approximately 1969 to
1980. The South Carolina Department of Health
and Environmental Control (SCDHEC) reported
that the wastewater contained some organic cleaning solvents, phosphate, cyanide, chromium, cadmium, lead, mercury, nickel, zinc, copper and iron.
In April 1980 the Blake and Johnson Company
ceased operation. Two months later the Independent Nail Company purchased the plant. They currently operate a paneling nail coating process at
the plant, but do not discharge any wastewater to
the lagoon. The primary contaminants of concern
to the soil and sediment include: cadmium, chromium, nickel and zinc. The selected remedial action
for this site includes: excavation of contaminated
colls and lagoon sediments. solidification/stabilizaum, nickel and zinc. The selected remedial action for this site includes: excavation of contaminated soils and lagoon sediments; solidification/stabilization of excavated soils and sediments (6,200 cu yd); placement of treated soils and sediments back into the excavated lagoon and cover with 6 inches of top soil and seed. The estimated capital cost for this remedial action is \$1,032,000 with annual operation and maintenance of \$22,000 for years 1-2 and \$5,600 for years 3-30. (Author's abstract) W89-02980

SUPERFUND RECORD OF DECISION: ENDI-COTT WELL FIELD, NY.

Environmental Protection Agency, Washington,

Group 5G-Water Quality Control

DC. Office of Emergency and Remedial Response. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-185772. Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA/ROD/R02-87/048, September 1987. 38p, 9 fig, 4 tab.

Descriptors: *Superfund, *Water pollution treatment, *Water pollution sources, *Cleanup operations, Broome County, New York, Vinyl chloride, Volatile organic compounds, Organic compounds, Air stripping, Costs

The Endicott Village Well Field site is located in Endicott Village, Broome County, New York. The site consists of well and its zone of influence on area groundwater. Landfills and industrial tracts of area groundwater. Landfills and industrial tracts of land are located to the northwest and west of the study area including the Endicott Landfill, identified as the probable source of contamination. In the 1950s the Ranney Well Collector Corporation developed the well at the site for use by the village of Endicott. After a May 1981 chemical spill nearby, the well was sampled and found to contain viny chloride and trace amounts of other VOCs. Remedial actions undertaken by the Endicott Public Works Department included sampling and eventual closing of radial discharges from the Ranney well. Additionally, an aeration system was installed in the well to reduce vinyl chloride levels. Subsequent actions undertaken included the installation of monitoring wells and a purge well between the of monitoring wells and a purge well between the Ranney well and the Endicott Landfill. The select-Ranney well and the Endicott Landfill. The selected remedial action for this operable unit includes: installation and operation of an air stripping system to remove VOCs and vinyl chloride from the Ranney well; continued operation of the purge well located between the Ranney well and the Endicott Landfill; and continued monitoring of the Ranney well to detect the presence of vinyl chloride and other VOCs. The estimated capital cost for this remedial action is \$1,200,000 with annual operation and maintenance of \$147,000. (Author's abstract) W89-02983

SUPERFUND RECORD OF DECISION: VEGA

ALTA, PR.
Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-185764. Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA/ROD/R02-87/050, September 1987. 79p, 11 fig, 11 tab, append.

Descriptors: *Superfund, *Water pollution treatment, *Water pollution sources, *Water treatment, *Cleanup operations, *Puerto Rico, Vega Alta, Path of pollutants, Groundwater pollution, Trichloroethylene, Tetrachloroethane, Dichloroethene, Volatile organic compounds, Organic compounds.

The Vega Alta Public Supply Wells site is a public water supply well field located in the municipality of Vega Alta, Puerto Rico, approximately 32 km west of San Juan where groundwater is the primary source of water. The well field consists of eight active and two inactive wells. It currently supplies about 3.8 million gpd of water to Vega Alta and surrounding residential areas. The Puerto Rico Aqueduct and Sewer Authority (PRASA) is responsible for operation and maintenance of the public water supply system. The first indication of contamination was discovered in June 1983, when a survey of public water wells made by the USGS detected 574 micrograms/L of trichloroethylene detected 574 micrograms/L of trichloroethylene (TCE) in the Ponderosa public supply well. Other VOCs were detected at lower concentrations in non-public wells in the well field system and groundwater contamination was suspected. In June and August of 1983 Ponderosa and well GE 1 were shut down by PRASA because of contamination, respectively. This shut down caused a potential water supply shortage in Vega Alta. PRASA constructed well Bajura 3 to eliminate the shortage. In 1984 an air stripper was constructed at the Ponderosa well and operated until May 1985 when the chnical problems arose with the air stripper. Curechinical problems arose with the air stripper. Cure reductosa wer and operated until may 1963 may 1963 metechnical problems arose with the air stripper. Currently, groundwater is contaminated with 1,1,1-trichloroethene, tetrachloroethene, 1,2-dichloroethene, 1,1-dichloroethene and other VOCs. The

selected remedial action for this site includes: treat-ment of PRASA wells GE 1, GE 2 and Bajura 3 by individual treatment systems with discharge of treated effluent into the PRASA distribution treated effluent into the PRASA distribution system for public use; treatment of Ponderosa well by scaling pretreatment and air stripping; discharge of treated effluent from the Ponderosa well to Honda Creek; shut down of Monterrey 2 and G and M private wells with hookup to the PRASA distribution system; and initiation of a subsequent RI/FS to assess fully and evaluate the source(s) of contamination. The estimated capital cost for this remedial action is \$4,106,000 with annual O and M of \$581,000. (Author's abstract)

CONSERVATION AIMS, CRITERIA, AND GOALS FOR RIVERS,

Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies.

For primary bibliographic entry see Field 2H. W89-02987

CONSERVATION MANAGEMENT OPTIONS

FOR RIVERS,
Transval Afdeling Natuurbewaring, Pretoria (South Africa). For primary bibliographic entry see Field 6A. W89-02989

INSTALLATION RESTORATION PROGRAM PHASE II - CONFIRMATION/QUANTIFICA-TION, STAGE I,

Radian Corp., Austin, TX.
For primary bibliographic entry see Field 5B.
W89-02999

QUALITY OF GROUND WATER IN THE PAYETTE RIVER BASIN, IDAHO,
Geological Survey, Boise, ID. Water Resources

D. J. Paruman. Available from Books and Open File Report Sec-tion, USGS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4013, 1986. 85p., 14 fig, 8 tab, 45 ref, 2 append, 2 plates in pocket.

Descriptors: *Water quality, *Groundwater, *Payette River Basin, *Chemical properties, *Drinking water, Domestic water, Agriculture, Geohydrology, Hardness, Alkalinity, Hydrogen ion concentration, Nitrites, Nitrates, Sulfates, Chlorides, Fluorides, Iron, Manganese, Zinc, Dissolved solids, Well water, Idaho, Metals, Aquifers.

As part of a study to obtain groundwater quality data in areas of Idaho were land- and water-resource development is expected to increase, water quality, geologic, and hydrologic data were collected for 74 wells in the Payette River basin, west-central Idaho, from July to October 1982. Historical (pre-1982) data from 13 wells were compiled with more recent (1982) data to define, on a presentitive service best were compiled with more recent (1982) data to define, on a pied with more recent (1922) data to define, on a reconnaissance level, water quality conditions in major aquifers and to identify factors that may have affected groundwater quality. Water from the major aquifers generally contains predominantly calcium, magnesium, and bicarbonate plus carbon-ate ions. Sodium and bicarbonate or sulfate are the predominant ions in groundwater from 25% of the 1982 samples. Areally, groundwater from the upper Payette River basin has proportionately lower ion concentrations than water from the lower Payette River basin. Water samples from wells < 100 ft deep generally have lower ion concentrations than samples from wells > 100 ft concentrations than samples from wells > 100 ft deep. Variations in groundwater quality probably are most affected by differences in aquifer composition and proximity to source(s) of recharge. Groundwater in the study area is generally suitable for most uses. In localized areas, pH and concentrations of hardness, alkalinity, dissolved solids, or dissolved nitrite plus nitrate as nitrogen, sulfate, fluoride, iron, or manganese exceed Federal drink-ing water limits and may restrict some uses of the water. (Author's abstract)

CRITICAL ASSESSMENT OF THE 'DYNAMIC DAPHNIA TEST' (KRITISCHE BETRACH-TUNG DES 'DYNAMISCHEN DAPHNIEN TESTS'),

Bayer A.G., Leverkusen (Germany, F.R.). Plastics and Coatings Div.

For primary bibliographic entry see Field 5A. W89-03046

ENGINEERING, MOSQUITOES AND FILARIASIS: A CASE REPORT,

ASIS: A CASE REPORT,
London School of Hygiene and Tropical Medicine
(England). Dept. of Tropical Hygiene.
S. Cairncross, A. R. Rajavel, P. Vanamail, S.
Subramaniam, and K. P. Paily.
Journal of Tropical Medicine and Hygiene, Vol.
91, No. 3, p 101-106, June 1988. 1 fig, 2 tab, 6 ref.

Descriptors: *India, *Parasitism, *Mosquitoes, *Public health, *Sanitary engineering, Filariasis

The results of the larval surveys were used to assess the relative numbers of mosquitoes breeding in different types of habitat and in different parts of the town of Pondicherry, India. The results illustrate an effective method to set priorities for mosquito control by identifying the most significant breeding sites in a town, and show that they are not necessarily the most obvious, the most extensive or those intuitively most likely. (Author's abstract) W89-03065

SCHISTOSOMIASIS CONTROL IN IRRIGA-TION SCHEMES IN ZIMBABWE,

Hydraulics Research Ltd., Wallingford (England). P. Bolton.

Journal of Tropical Medicine and Hygiene, Vol. 91, No. 3, p 107-114, June 1988. 5 fig, 8 ref.

Descriptors: *Zimbabwe, *Parasitism, *Sanitary engineering, *Irrigation, *Human diseases, Schistosomiasis, Snails, Molluscicides, Public health.

The potential contribution by engineers to the con-In the potential contribution by engineers to the con-trol of schitosomiasis in irrigation schemes was examined with reference to work in Zimbabwe. In larger schemes, snail control using molluscicides has proved effective. In smaller schemes, where this is impracticable, careful design and operation may reduce transmission. Appropriate measures are currently being assessed in a pilot project. (Author's abstract) (Author's abstract) W89-03066

GROUNDWATER MICROBIOLOGY: PROBLEMS AND BIOLOGICAL TREATMENT: STATE-OF-THE-ART REPORT,

Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
For primary bibliographic entry see Field 2F.
W89-03075

APPLICATION OF ENVIRONMENTAL RISK ANALYSIS TO GROUNDWATER PROTEC-

Insinoori- ja Limnologitoimisto Oy Vesitekniikka A.B., Salpakangas (Finland).
M. O. Ettala. Water Science and Technology WSTED4, Vol. 20, No. 3, p 87-93, 1988. 2 fig, 1 tab, 7 ref.

Descriptors: *Water quality control, *Risk assessment, *Environmental protection, *Groundwater protection, *Groundwater quality, Water supply, Waste disposal, Industrial wastes, Air pollution, Chemical industry, Food processing industry, Forest industry, Groundwater pollution.

Industrial hazards can be divided into risks relating to property, persons, know-how and operations. The operational risks include risks to the environment, against which the industry is generally not insured. Environmental risk management is necessitated by the growth of legislation for environmental protection, by the economic losses involved in environmental damage and by the unfavorable image created by such damage for the industry. In

Water Quality Control—Group 5G

1985-87, environmental risk analysis was applied at 4 factories and 4 refuse disposal systems in the fields of chemistry, forest industry and foodstuffs. The analysis covers organization of the different process stages, air pollution, waste disposal and problems connected with the surface and groundwater. Consideration of the groundwater risks must take into account the hydrogeological conditions, sources of pollution, use and monitoring of groundwater, and estimation of magnitude of groundwater, and estimation of magnitude of damage. A wide variety of factors affecting the quality of the groundwater supply must also be included in the analysis. As in normal risk analysis, the study consists of identification and quantification of the risks and comparison of alternative measures. However, environmental risks were not found to be identifiable solely by fault tree of action error analysis, by hazard and operability study or by management oversight and risk tree analysis. As in other fields, specialists are needed for a site study of groundwater issues in the factories. Check lists were prepared for use when the personnel at different organization levels are interviewed. Serious environmental risks were found to viewed. Serious environmental risks were found to be caused by deficiencies in the functioning of the organization, in information and allocation of responsibility. Permits, agreements, etc. frequently been disregarded and many technical deficiencies have endangered the groundwater quality or supply. (Author's abstract) W89-03083

BIOLOGICAL TREATMENT OF GROUND-WATER IN BASINS WITH FLOATING FIL-TERS: II. THE ROLE OF MICROORGANISMS IN FLOATING FILTERS,

inki Univ. (Finland). Dept. of Limnology.

H. Seppanen. Water Science and Technology WSTED4, Vol. 20, No. 3, p 185-187, 1988. 4 ref.

Descriptors: *Groundwater, *Microorganisms, *Water treatment, *Biological treatment, *Filtration, *Bacteria, Floating filters, Iron, Manganese.

Bacteria and other organisms participate in the precipitation of soluble iron and manganese in many different ways. The production of hydrogen peroxide seems to be an important phase in the formation of the precipitates. Bacteria produce hydrogen peroxide as an intermediate or an end producer. uct of metabolic processes. Iron and manganese bacteria are typical gradient organisms, growing in a sharp gradient between oxidized and reduced a sharp gradient between oxidized and reduced environments. Iron precipitating types are oligoptrophic and manganese precipitating types need higher concentrations of organic compounds. Manganese precipitating bacteria are eutrophic. Iron bacteria are sessile, and grow attached to the solid surface of filter media. Typical iron nd manganese precipitating bacteria in groundwater are Gallionella, Leptothrix, and Metallogenium. (See also W89-03094) (Author's abstract) W89-03095

IN SITU BIOLOGICAL GROUNDWATER DEN-ITRIFICATION: CONCEPTS AND PRELIMI-

Tahal Consulting Engineers Ltd., Tel-Aviv (Israel). Water Resources and Environmental En-

gineering Div. A. Mercado, M. Libhaber, and M. I. M. Soares. Water Science and Technology WSTED4, Vol. 20, No. 3, p 197-209, 1988. 9 fig. 1 tab, 8 ref.

Descriptors: *Water quality control, *Water pollu-tion treatment, *Groundwater, *Biological treat-ment, *Water pollution, *Nitrates, *Denitrification, *Injection wells, Pilot plants, In situ tests.

High nitrate concentration presents the main groundwater quality problem of the Israeli coastal aquifer which supplies 25% of the total water consumption of the country. In about 50% of the coastal wells it nitrates concentration exceeds 45 mg/l and in 18% of the wells it is above the maximum permissible concentration of the new Israeli standard, 70 mg/l. Although several protection measures, mainly administrative, were intro-duced, their impact would be pronounced only after 1-3 decades; thus nitrate removal technologies

could be introduced as a mid-term solution. Pilot plant experiments were conducted in order to develop, demonstrate and compare various in situ schemes for nitrate removal from groundwater by biological denitrification. Activities were focused towards two schemes: (i) denitrification in a dual purpose (recharge-pumping) well and (ii) substrate injection through a battery of small diameter wells surrounding a central production well (the Daisy system). Experiments related to the first scheme indicate that, though nitrate content can be reduced almost to zero, its economic feasibility seems to be unfavorable because of operational difficulties and the apparent requirements for costly supplementary treatment. Experiments related to the Daisy scheme demonstrated a nitrate removal efficiency of 10%. Considering the fact that only one injection well of the three drilled functioned properly, the above mentioned nitrate removal represents the efficiency of a single injection well. It is anticipated that further experiments with the Daisy system consisting of 5-6 injection wells would result in a significant nitrate reduction. (Author's abstract) W89-03097 could be introduced as a mid-term solution. Pilot

BIODEGRADATION MODELING AT AVIA-

BIODEGRADATION MODELING AT AVIA-TION FUEL SPILL SITE, Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
H. S. Rifai, P. B. Bedient, J. T. Wilson, K. M. Miller, and J. M. Armstrong.
Journal of Environmental Engineering (ASCE) JOEDDU, Vol. 114, No. 5, p 1007-1029, October 1088, 13 fig. 2 tah. 25 ref. 1988, 13 fig. 2 tab, 25 ref.

Descriptors: "Aquifers, "Biodegradation, "Model studies, "Water pollution control, "Fate of pollutants, "Cleanup, "Oil spills, "Groundwater pollution, Oxygen transfer, Path of pollutants, Bioplume II model, Gasoline.

Biodegradation has recently emerged as an effective process for contaminant attenuation in aquifers. The development of a 2-dimensional model (BIOPLUME II) for contaminant transport influenced by oxygen-limited biodegradation is presented. The model uses a dual-particle mover concept to simulate the transport of contaminants and oxygen in the subsurface. The reaction between oxygen and the contaminants is assumed to be instantaneous and its simulated using the princip tween oxygen and the contaminants is assumed to be instantaneous and is simulated using the principle of superposition. Preliminary results are presented from a modeling effort using BIOPLUME II at an aviation gasoline spill where biodegradation is known to occur. The model was calibrated of field data collected before the installation of an interception pumping system at the site. The model was also used to simulate field conditions at the site over a two-year period with the pumping system in operation. The model predictions evidently match the observed data and the observed rate of contaminant mass loss at the site reasonably well. (Author's abstract)

DYE-SENSITIZED PHOTOCHEMICAL REDUCTION OF PCBS.

Virginia Polytechnic Inst. and State Univ., Blacks-burg. Dept. of Civil Engineering. For primary bibliographic entry see Field 5D. W89-03101

LEACHATE COLLECTION IN LANDFILLS: STEADY CASE,

Kansas Univ., Lawrence. Dept. of Civil Engineer-

For primary bibliographic entry see Field 5E. W89-03102

FATE OF ADDED ALKALINITY DURING NEUTRALIZATION OF ACID LAKE,

Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering. J. J. Bisogni.

Journal of Environmental Engineering (ASCE) JOEDDU, Vol. 114, No. 5, p 1219-1224, October 1988. 3 fig, 7 ref.

Descriptors: *Alkalinity, *Lakes, *Acidic water, *Acid rain, *Lake restoration, Acidification, Wolf Pond, Liming, Acid neutralization, Sodium bicarbonate, Sodium fate, New York.

The relatively low cost of lime products (e.g., Ca(OH)2, Ca(O3) has favored the use of these chemicals in lake neutralization. NaHCO3 and NaZCO3 are more costly neutralizing agents but offer a solubility advantage over lime products. However, very little acid lake neutralization experience exists with these basic sodium salts. An attempt was made to neutralize an acidic lake with attempt was made to neutralize an acidic lake with sodium bicarbonate for the purpose of determining the fate of added alkalinity. Evaluation of the magnitudes of these fates is important in estimating required neutralizing agent dosages. Neutralization studies were carried out on Wolf Pond, an acid lake located in Franklin County, New York. Measurements of pH, alkalinity as well as the fate and distribution of set distributions. urements of pH, alkalinity as well as the fate and distribution of sodium were made over a period of several months after sodium bicarbonate was added. The use of of sodium bicarbonate provides a means to determine the fate of alkalinity to an acid lake. The conservative nature of the sodium ion was exploited to trace added alkalinity. It appears that the major fate of added alkalinity in Wolf Pond is depletion by hydraulic washout. Internal alkalinity generation and atmospheric acidity input appear to be approximately of the same magnitude for Wolf Pond. (Brock-PTT) W89-03111

PHOSPHATE REQUIREMENT FOR ANAERO-BIC FIXED FILM TREATMENT OF LANDFILL LEACHATE.

Technical Univ. of Nova Scotia, Halifax. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W89-03132

ENVIRONMENTAL MANAGEMENT OF THE ZAMBEZI RIVER SYSTEM,

Ministry of Agriculture and Water Development, Lusaka (Zambia).

L. L. Mbumwae.

Regulated Rivers - Research and Management RRMEP, Vol. 2, No.4, p 553-557, September-Oc-tober 1988. 1 tab.

Descriptors: *Environmental management, *Water management, *Rivers, *Riparian waters, Manage-ment planning, Policy making, Zambezi River, De-veloping countries, Erosion, Monitoring.

In order to achieve environmentally sound management of the Zambezi River and its basin, an Action Plan involving the cooperation of the eight countries of the basin (Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania, Zambia, and Zimbabwe) has been produced. This paper introduces the Action Plan, which is not only aimed at a systematic investigation of environmental aspects of development, but also making sure that properly designed policies and programs are formulated by riparian countries. There are 19 Zambesi Action Plan Projects, several of which include 3-6 subprojects. They concern such activities as institutional jects. They concern such activities as institutional data coordination, monitoring of environmental impacts, feasibility studies, and erosion control. (Brock-PTT) W89-03144

ATTEMPT TO FACILITATE WATER MAN-AGEMENT ISSUES IN THE ZAMBEZI RIVER BASIN USING DECISION SUPPORT SYS-TEMS.

International Inst. for Applied Systems Analysis, Laxenburg (Austria).
G. Pinay, K. A. Salewicz, and G. Kovacs.

Regulated Rivers - Research and Management RRMEP, Vol. 2, No.4, p 559-563, September-October 1988. 1 fig, 3 tab, 12 ref.

Descriptors: "Policy making, "Regulated rivers, "Water management, "Riparian waters, Zambezi River, Developing countries, Systems analysis, Computer programs, Reservoir operation.

Group 5G-Water Quality Control

In order to address at least some of the crucial issues which are common to countries sharing a large river basin, the 'Decision Support Systems for Managing Large International Rivers Project' (LIR) was initiated within the framework of the Environment Program at the International Insti-tute for Applied Systems Analysis (IIASA). The basic objective of the project is to develop a set of efficient analytical software tools for use by river basin commissions as well as by individual riparian countries to assess the consequences of various planning and management policy options. The LIR at IIASA and its application in the Zambezi River case study is reviewed. The first application of the software package will concern the reservoir operations of the middle Zambezi impoundments. (Brock-PTT) W89-03145

PILOT PLANT DEMONSTRATION OF INSITU BIODEGRADATION OF 1,1,1-TRICH-LOROETHANE.

RUIGET - The State Univ., New Brunswick, NJ. Dept. of Chemical and Biochemical Engineering. For primary bibliographic entry see Field 5D. W89-03164

FATE AND EFFECTS OF XANTHATES IN LABORATORY FRESHWATER SYSTEMS,

Wuhan Inst. of Hydrobiology (China). Y. Xu, J. P. Lay, and F. Korte

Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 41, No. 5, p 683-689, November 1988. 3 fig, 4 tab, 3 ref.

Descriptors: *Fate of pollutants, *Toxicity, *Water pollution treatment, *Xanthates, *Mine wastes, Duckweed, Aquatic plants, Daphnia, Bioaccumulation, Bioconcentration, Industrial wastes.

Xanthates (salts of the dithioformic acid-O-ester with a C-O-alkyl or aryl chain and C-S-metal ion) with a C-O-alkyl or aryl chain and C-S-metal ion) are mostly of a technical significance as 'samplers' of metal sulfides in mining flotation. They are known to be strong fish poisons with LD50 values of between 10 and 100 mg/L water. Recently xanthates are being discussed as helpful agents in environmental protection because of their ability to remove harmful heavy metals from contaminated waters. The present work was well-staken to accompany. waters. The present work was undertaken to provide more information on the fate and effects on aquatic organisms of these environmental chemi-cals. Results with Lemna minor (duckweed) revealed that (14)C-labeled potassium-ethylxanthate was rapidly taken up from the aqueous phase with maximum concentrations at 24 h after dosing. The results of the toxic effects of four xanthates tested are summarized, showing lethality and growth in-hibition at concentrations varying from less than 5 to 20 mg/L. The 24-hour EC50 (immobilization) values for Daphnia magna were 0.35 mg/L for sodium ethylxanthate, and ranged from 3.0-3.7 mg/ sodium ethylxanthate, and ranged from 3.0-3.7 mg/ L for sodium isopropylxanthate, sodium isobutylx-anthate and potassium pentylxanthate. It was also demonstrated that the chemical half-lives of xanth-ates in water range from about 2.5 to 4 days (C2-C5-alkyl). (VerNooy-PTT) W89-03201

INFLUENCE OF NUTRIENT ENRICHMENT AND LIGHT AVAILABILITY ON THE ABUN-DANCE OF AQUATIC MACROPHYTES IN FLORIDA STREAMS,

Florida Univ., Gainesville. Dept. of Fisheries and Aquaculture.

For primary bibliographic entry see Field 5C.

STRINGFELLOW LEACHATE TREATMENT WITH RRC.

Environmental Protection Agency, Cincinnati, OH. Hazardous Waste Engineering Research Lab. For primary bibliographic entry see Field 5D. W89-03328

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

MONITORING, RESEARCH, AND MANAGE-MENT: INTEGRATION FOR DECISIONMAK-ING IN COASTAL MARINE ENVIRONMENTS, National Oceanic and Atmospheric Administra-tion, Rockville, MD. Ocean Assessments Div. For primary bibliographic entry see Field 5A. W89-02323

ENVIRONMENTAL AUDITING: MANAGE-MENT'S KEY TO EFFECTIVE ENVIRONMEN-TAL COMPILANCE, Mabbett, Capaccio and Associates, Inc., Cam-bridge, MA. R. S. Capaccio, A. N. Mabbett, and A. J. Cunningham. IN: 8th AESF/EPA Conference on Pollution

Cunningham.

IN: 8th AESF/EPA Conference on Pollution Control for the Metal Finishing Industry. EPA Report No. EPA/600/9-87/012, July 1987. p 257-268, 4 ref.

Descriptors: *Environmental protection, *Management planning, *Environmental policy, *Regulations, Monitoring, Hazardous materials, Enforcement, Water pollution control, Industrial wastes.

Environmental auditing can be management's key to effective environmental compliance by assessing ones status with a myriad of changing regulatory requirements. Since environmental auditing activirequirements. Since environmental auditing activities represent a relatively new technique for industry, the definition and methods of conducting an audit may vary significantly. The environmental audit may vary significantly. The generally accepted definition used by the EPA defines an environmental audit as a 'systematic, documented, periodic and objective review of fadocumented, periodic and objective review of facility operations and practices related to meeting environmental requirements.' Some of the reasons for performing an environmental audit are given and deficiencies frequently identified during audits of manufacturing facilities are summarized. Common compliance problems include lack of documentation/record keeping, inadequate practices employed in handling hazardous, and inadequate management procedures and training. (See also W89-02392) (Lantz-PTT) W89-02409

ADVISORY SYSTEM FOR NORTH CAROLINA GROUNDWATER QUALITY MODELING AND MANAGEMENT NEEDS, Duke Univ, Durham, NC. Dept. of Civil and Environmental Engineering. For primary bibliographic entry see Field 5G. W89-02548

MICROCOMPUTER PROGRAM DEVELOP-MENT FOR ON-FARM IRRIGATION SYS-TEMS PLANNING, Idaho Univ., Moscow. Dept. of Agricultural Engi-

neering.
B. A. King, B. A. Sauer, and J. R. Busch.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB88-235783/
AS. Price codes: Al7 in paper copy; A01 in microfiche. Idaho Water Resources Research Institute
Moscow, Completion Report, May 1987. 385p, 85
fig. 2 tab, 28 ref, 8 append. Contract No. 14-080001-G1222.

Descriptors: *System analysis, *Irrigation design, *Simulation analysis, *Computer models, Irrigation, Pacific Northwest, Computer programs, Irrigation practices, Crop rotation, Irrigation systems information.

A simulation modeling package has been developed for the purpose of critically evaluating onfarm irrigation water supply and application systems under Pacific Northwest conditions. The entire package is designed to be executed on a microcomputer. The modeling package incorporates climatic, farm layout and management factors in conjunction with irrigation systems information

The modeling procedure can consider up to 6 different application systems supplied from a common water source applying water to total 11 fields. The crop rotation pattern for each field can be up to 9 years with 2 crops per year. The procedure is designed to be used as a planning tool for determining the projected operation of an irrigation system on a given farm under site-specific conditions. (IWRRI) W80_02550

HYDROLOGY VERSUS WATER RESOURCES MANAGEMENT, Slovenska Akademia Vied, Bratislava (Czechoslovakia). Ustav Hydrologie a Hydrauliky. For primary bibliographic entry see Field 2A. W89-02724

FLOOD HAZARD MANAGEMENT: BRITISH AND INTERNATIONAL PERSPECTIVES. For primary bibliographic entry see Field 4A. W89-02743

FLOOD PROBLEM IN PERSPECTIVE, Middlesex Polytechnic, London (England). Flood Hazard Research Centre. For primary bibliographic entry see Field 4A. W89-02744

URBAN FLOOD PROBLEMS: THEIR SCALE AND THE POLICY RESPONSE, Ministry of Agriculture, Fisheries and Food, London (England). For primary bibliographic entry see Field 4A. W89-02746

FLOOD LOSS REDUCTION BY METROPOLITAN REGIONAL AUTHORITIES IN THE UNITED STATES,

Massachusetts Univ., Amherst. Dept. of Geology and Geography. For primary bibliographic entry see Field 6E. W89-02752

WARNING DISSEMINATION AN SPONSE WITH SHORT LEAD TIMES, AND RE-Colorado Univ. at Colorado Springs. Dept. of Geography and Environmental Studies. For primary bibliographic entry see Field 6F. W89-02754

IT'S YOUR CHOICE: A GUIDEBOOK FOR LOCAL OFFICIALS ON SMALL COMMUNITY WASTEWATER MANAGEMENT OPTIONS. Environmental Protection Agency, Washington, DC. Municipal Facilities Div. For primary bibliographic entry see Field 5D. W89-02838

WASTE MINIMIZATION AUDIT REPORT: CASE STUDIES OF MINIMIZATION OF SOL-VENT WASTES AND ELECTROPLATING WASTES AT A DOD (DEPARTMENT OF DE-FENSE) INSTALLATION, Versar, Inc., Springfield, VA. For primary bibliographic entry see Field 5D. W89-02839

CORRECTIVE MEASURES FOR RELEASES TO GROUNDWATER FROM SOLID WASTE MANAGEMENT UNITS, GCA Corp., Bedford, MA. GCA Technology

Div. For primary bibliographic entry see Field 5G. W89-02844

CONSERVATION MANAGEMENT OPTIONS

FOR RIVERS, Transvaal Afdeling Natuurbewaring, Pretoria (South Africa).
C. J. Kleynhans, M. N. Bruton, J. A. Day, R. N. Porter, and C. P. R. Roberts.

Evaluation Process—Group 6B

IN: Conservation of South African Rivers, 1986, p.

Descriptors: *Water resources management, *Water conservation, *Rivers, *South Africa, Conservation, River regulations, Management plan-

Conservation management involves an interference with rivers to produce desired changes or to prevent undesirable changes. In order to decide vent undestrable changes. In order to decide whether management is necessary and what measures must be taken in different instances, rivers need to be classified on two scales, i.e., in terms of their conservation status and their conservation importance. Different parts of a river system could be given different gradings. Rivers which have a high conservation importance but a low conservahigh conservation importance but a low conserva-tion status need the most urgent attention, and the aim will be to raise their conservation status to the highest practical level. For any management deci-sions to be made, it is important to have a funda-mental understanding of the way in which a river functions, the consequences of perturbations, and a value system which allows judgements to be made about priorities. Reviewing whether management is necessary and what the conservation goals should be can help determine the direction of should be, can help determine the direction of management. Two possibilities for the management of a scarce resource such as water have been proposed in the literature: (a) the first is the maximum feasible sustainable state which essentially relies on continued technological advancement to renes on continued technological advancement to maximize the resource as the solution to the scarci-ty problem; and (b) the frugal sustainable state in which no goals of maximizing the amounts of the resource that will be used are set. (See also W89-02985) (Lantz-PTT)

6B. Evaluation Process

OPTIMIZING OPERATION AND MAINTE-NANCE OF WATER SUPPLY WELLS, Weston (Roy F.), Inc., West Chester, PA.

Weston (Roy F.), inc., west Chester, FA.
J. Tavangar.
IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 15-29, 2 fig, 4 tab.

Descriptors: *Maintenance, *Pumping, *Wells, *Water well maintenance, *Model studies, *Cost analysis, *Water supply systems, *Economic as-pects, Aquifers, Water quality, Groundwater moni-toring, Mathematical studies, Groundwater, Groundwater management.

As population and demand for water grow and new sources of water become expensive and scarce, the need for better management of existing scarce, the need for better management of existing water supply systems becomes apparent. Ground-water plays an important role in the water picture of many municipalities and is often the best quality and the most reliable source of water available. However, because of overpumping, water levels are declining in most aquifers. This has resulted in higher pumping costs, and in some cases, extraction of lower quality water. In addition, as water systems age and deteriorate, their efficiencies often decline, resulting in lower production rates and higher energy costs. Since the process of deterioration usually takes place over a relatively long period, it is not easily detected and quantified unless a systematic testing and monitoring program unless a systematic testing and monitoring program is in place. In case of a decline in well or pump efficiency, a choice must be made regarding the type of rehabilitation measures that would yield the best economic results. A detailed economic evaluation procedure is presented for selecting the most cost-effective rehabilitation measures from the many alternatives available for improving inefficient systems. An interactive computer model has ficient systems. An interactive computer model has been developed to facilitate the application of this economic analysis procedure and to assist in the collection and updating of a data base necessary for such an analysis. A procedure is also presented for optimizing the operation of water supply wells to minimize the overall pumping cost of the system. (See also W89-02331) (Author's abstract) W89-02333

WASTEWATER TREATMENT: OPTIMIZING AN EXISTING SYSTEM, Harris Corp., Melbourne, FL. For primary bibliographic entry see Field 5D. W89-02406

PROCEEDINGS, SEVENTEENTH MISSISIP-PI WATER RESOURCES CONFERENCE, 25-26 MARCH, 1987, JACKSON, MISSISSIPPI. Mississippi State Univ., Mississippi State. Water Resources Research Inst.

Resources Research Inst. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-116769/ AS. Price codes: A06 in paper copy; A01 in micro-fiche. Proceedings Report, 1987. 110p. Edited by E. J. Hawkins. Contract No. G1234.

Descriptors: *Water management, *Data storage, *Data retrieval, *Model studies, *Groundwater movement, Water law, Computer models, Mathematical models, Hydraulic models, Surface water, Economic impact, Waterways, Irrigation, Flood-

The proceedings of the seventeenth Mississippi water resources conference are compiled. In this conference, papers focused on specific problems, systems, and methods applicable to water management in the State and the region. Twenty-one papers by separate authors addressed information/data management, assessed impacts of the 1986 drought, presented modeling techniques for various surface and groundwater problems, presented water quality studies, reviewed alternatives sources of supply, and discussed water allocation. (USGS) (USGS) W89-02476

WATER AND ARID LANDS OF THE WEST-ERN UNITED STATES. For primary bibliographic entry see Field 6D. W89-02630

WEST IN PROFILE, World Resources Inst., Washington, DC. For primary bibliographic entry see Field 6D. W89-02631

CENTRAL VALLEY OF CALIFORNIA, California Univ., Davis. For primary bibliographic entry see Field 6D. W89-02633

WATER RESOURCES OF THE UPPER COLO-RADO RIVER BASIN: PROBLEMS AND POLICY ALTERNATIVES,

Colorado Univ., Boulder. For primary bibliographic entry see Field 6D. W89-02635

TOWARD SUSTAINING A DESERT METROP-OLIS: WATER AND LAND USE IN TUCSON, ARIZONA, Arizona Univ., Tucson. For primary bibliographic entry see Field 6D. W89-02637

WATER MANAGEMENT ISSUES IN THE DENVER, COLORADO, URBAN AREA, Milliken Chapman Research Group, Inc., Little-

For primary bibliographic entry see Field 6D. W89-02638

NEW WATER POLICIES FOR THE WEST, World Resources Inst., Washington, DC. For primary bibliographic entry see Field 6D. W89-02639

DEVELOPING A STATE GROUND WATER POLICY IN THE CORN BELT: THE IOWA

IT Corp., Monroeville, PA. For primary bibliographic entry see Field 2F. W89-02681

POWER BEHIND THE FLOOD SCENE. Middlesex Polytechnic, London (England). Flood Hazard Research Centre.

For primary bibliographic entry see Field 6E. W89-02747

SOCIAL CHOICE AND BENEFIT-COST ANAL-

Middlesex Polytechnic, London (England). Flood Hazard Research Centre. C. H. Green

C. h. Green. IN: Flood Hazard Management: British and Inter-national Perspectives. Geo Books, Norwich, Eng-land. 1987. p 219-244, 3 fig, 7 tab, 37 ref.

Descriptors: *Cost-benefit analysis, *Risks, *Flood control, *Flood plain management, *Social aspects, Surveys, Economic aspects, Flood damage, Theoretical analysis, Public policy, Tangible benefits, Flood benefits, Comparative benefits, Public

benefits.

Benefit-cost analysis (BCA) is a procedure whose rationale is that since economists cannot define ends or social goals in any rigorous manner, soley the economic efficiency implications of projects are analyzed. The intent is then that this rigorous analysis of the efficiency implications will be melded into assessing the project against other social goals. BCA applied to flood control projects can easily ignore the most important data. Since the social goals served by flood alleviation are not defined in Britain, it is easily assumed that economic efficiency is the goal merely because a project's success can be quantified on this basis. Second, BCAs typically exclude some impacts as intangibles which affect the project's efficiency. What is included need not be so much what is important awhat is easily measured. Not only are the results thereby distorted, but the intangibles may be regarded as unimportant merely because they are not quantified. A third danger is that in carrying out analyses pragmatic feasibility can negate the importance of theoretical correctness. A review of these of the order to overcome some of them. these problems is presented along with a report of the work being done to overcome some of them. (See also W89-02743) (Author's abstract) W89-02756

ASSESSING THE HEALTH EFFECTS OF

ASSESSING THE HEALTH EFFECTS OF FLOODS, Greater London Council (England). Dept. of Public Health Engineering. For primary bibliographic entry see Field 2E. W89-02757

PROJECT APPRAISAL, RESOURCE ALLOCA-TION AND PUBLIC INVOLVEMENT, Bayerisches Landesamt fuer Wasserwirtschaft, Munich (Germany, F.R.). For primary bibliographic entry see Field 6E. W89-02758

VALUE ENGINEERING FOR SMALL COM-MUNITIES.

Environmental Protection Agency, Washington, DC. Office of the Assistant Administrator for

water. Available from the National Technical Information Service, Springfield, VA. 22161, as PB88-184858. Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA 430/09-87-011, March 1988. 33p, 10 fig, 6 ref, 4 append.

Descriptors: *Value engineering, *Construction costs, *Operating costs, *Engineering, *Wastewater treatment facilities, *Economic aspects, Costs, Finances.

The use of value engineering (VE) for wastewater treatment facilities during their design development is a proven management tool that saves money. Since September 1976, VE has been required for all wastewater treatment projects with an estimated construction cost of \$10 million or

Field 6-WATER RESOURCES PLANNING

Group 6B-Evaluation Process

more, if financial assistance was provided by the EPA. In addition, EPA has encouraged the use of VE on smaller projects. This program has been extremely successful in controlling the cost of construction, as well as in saving communities thousands of dollars each year in facility operating costs. This document provides guidance to communities which are considering the use of VE for their wastewater treatment projects. This document explains what VE is and provides examples; illustrates the cost of VE as well as its benefits; and provides a simplified contract clause (a standard provides a simplified contract clause (a standard scope of service) to be used in obtaining VE servscope of service) to be used in obtaining VE services. Because this document is intended to provide an overview of the VE process, details of the VE process have not been addressed. The use of VE for wastewater treatment facilities during their design development is a proven management tool that saves money. (Lantz-PTT) W89-02865

CONSERVATION OF SOUTH AFRICAN

RIVERS, Council for Scientific and Industrial Research, Pretoria (South Africa). Foundation for Research De-

For primary bibliographic entry see Field 2H. W89-02985

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

GROWTH AND WATER IN THE SOUTH COAST BASIN OF CALIFORNIA,

California Univ., Riverside. For primary bibliographic entry see Field 6D. W89-02636

6D. Water Demand

CASE STUDY OF MINIMUM STREAMFLOW FOR FISHERY HABITAT IN THE YAMPA

Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W89-02460

PROJECTIONS OF WATER AVAILABILITY IN THE LOWER RIO GRANDE, GILA-SAN FRANCISCO AND MIMBRES DRAINAGE BASINS TO 2005, New Mexico Univ., Albuquerque. Bureau of Busi-

New Mexico Univ., Albuquerque. Bureau of Business and Economic Research.
J. C. Tysseling, D. Boldt, and B. McDonald.
Available from the National Technical Information
Service, Springfield, VA 22161, as PB87-201042/
AS. Price codes: A09 in paper copy; A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces. Technical Completion Report
No. 212, October 1986. 172p, 44 tab, 2 maps, 36
ref, 3 append. Project No. 1345629.

Descriptors: *Water demand, *Forecasting, *Water requirements, *Long-term planning, Regional analysis, Competing uses, Water policy, Management, New Mexico, Lower Rio Grando, Gila-San Francisco drainage basin, Mimbres drain-

The management of New Mexico water resources requires an understanding of the magnitude and source of future water scarcity conditions. Without detailed information regarding the specific nature of future water scarcity conditions, resource manor future water scarcity conditions, resource man-agement activities may incorrectly assign priorities to particular scarcity-mitigating efforts. Current and projected water supply and demand conditions are analyzed for the Lower Rio Grande Surface Drainage Basin, the Gila River and San Francisco River Surface Drainage and Mimbres Closed Basin. This analysis relies on 1980 data and projects future water secretive confitions ourse 3.5. projects future water scarcity conditions over a 25-year period to 2005. Water use data for 1980 provided by the State Engineer Office is combined with economic and demographic data (from sever-al sources) to allow calculation of water use coeffi-

cients for differing water use sectors within the hydrologically defined portions of each county. Future water scarcity conditions are assessed by the State Engineer Office. The analysis identified increased water scarcity conditions in the projec-tion for both the Lower Rio Grande Surface Drainage Basin and Mimbres Closed Basin. The Drainage Basin and Mimbres Closed Basin. The 25-year protection of water resource demands in the Gila-San Francisco Surface Drainage Basin shows a decline in scarcity conditions. (McDonald-NM U.) W89-02474

PUMPAGE OF WATER IN LOUISIANA, 1985, Geological Survey, Baton Rouge, LA. Water Re-sources Div.

D. L. Lurry.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. Louisiana Water Resources Special Report No. 4, 1987. 14p, 6 fig, 3 tab, 15 ref.

Descriptors: *Groundwater, *Water utilization, *Louisiana, *Withdrawal, *Water use, Surface waters, Water supply, Domestic use, Public-supply use, Rural use, Irrigation use, Industrial use, Aqua-

In 1985, an estimated 10,420 Mgal/d (million gal-lons per day) of water was withdrawn for various purposes in Louisiana - about 1,450 Mgal/d of groundwater and about 8,970 Mgal/d of surface water. Total water withdrawals in the State de-creased by 16 percent from 1980 to 1985. For 1980 cet 1985 expendituser withdrawals users 14 and 1985, groundwater withdrawals were 14 percent and surface water withdrawals were 86 percent of the total withdrawals in the State. Groundcent of the total withdrawals in the State. Ground-water withdrawals decreased by 19 percent; whereas, surface water withdrawals decreased by 16 percent during this 5-year period. The totals of water withdrawn in 1985 for various purposes were as follows: public supply, 629 Mgal/d; industrial, 2,090 Mgal/d; power generation, 5,960 Mgal/d; rural domestic and livestock, 58 Mgal/d; and irrigation and aquaculture, 1, 680 Mgal/d; Groundwater was withdrawn at the following average rates for various purposes in 1985: public supply, 276 Mgal/d; industrial, 303 Mgal/d; power generation, 30 Mgal/d; rural domestic and livestock, 54 Mgal/d; and irrigation and aquaculture, 784 Mgal/d. Surface water was withdrawn at the following Mgal/d; and irrigation and aquaculture, 784 Mgal/d. Surface water was withdrawn at the following average rates for various purposes in 1985: public supply, 353 Mgal/d; industrial 1,790 Mgal/d; power generation, 5,930 Mgal/d; rural domestic and livestock, 4 Mgal/d; and irrigation and aquaculture, 891 Mgal/d. Industrial water withdrawals decreased by 1,580 Mgal/d from 1980 to 1985. This reflects a decrease of 43 percent from 1980. (USGS) W89-02506

WATER AND ARID LANDS OF THE WEST-ERN UNITED STATES.

ERN UNITED SIAIES.
Cambridge University Press, New York, 1988. A
World Resources Institute Book. 415p. Edited by
Mohamed T. El-Ashry and Diana C. Gibbons.

Descriptors: *Arid lands, *Semiarid lands, *Water allocation, *Water demand, *Western United States, *Water policy, *Regional planning, Water management, Water conservation, Water supply development, Water use efficiency.

The nature of water demands in agricultural and municipal sectors in the U.S. West is explored and policies for maximizing efficiency and minimizing the conflicts inherent in policy change are outlined. It is shown how the West can gradually lined. It is shown how the West can gradually move away from expensive supply-side projects and water subsidies and how it can control demand and reallocate existing supplies within water mar-kets, enhancing environmental quality in the proc-ess. Areas discussed include the Central Valley and ess. Areas discussed include the Central Valley and South Coast Basin of California, the Texas High Plains, the upper Colorado River Basin, Tucson, Arizona, and Denver, Colorado. Also addressed is the water management challenge other dry lands face. Numerous countries are also experiencing conflicts as they try to reallocate limited supplies from acriculture to when were Manufic the recommendation. from agriculture to urban uses. Many of the recom-mendations included here, when adapted to pre-vailing social, cultural, and economic conditions, could help increase the productivity of water and land resources in other regions. (See W89-02631 thru W89-02639) (VerNooy-PTT)

WEST IN PROFILE, World Resources Inst., Washington, DC. M. T. El-Ashry, and D. C. Gibbons. IN: Water and Arid Lands of the Western United States. Cambridge University Press, New 1988. p 1-19, 3 fig, 4 tab, 34 ref.

Descriptors: *Arid lands, *Semiarid lands, *Water demand, *Municipal water, *Irrigation requirements, *Water management, Water conservation, water allocation, Water use efficiency, Western United States, Urbanization, Irrigation effects, Sabilities

Water development in the American West has been shaped by the region's geography, legal and institutional arrangements, urban expansion, and the spread of irrigated agriculture. From the grasslands of west Texas to the deserts of Arizona, the southwest quadrant of the United States is the most arid part of the country. The geography of this area affected the history of its water law development. Another factor exerting increasing pressure on water allocation is the rapid growth of urban areas and their increasing municipal water demands. Although municipal and industrial water needs are growing, water use in the West remains dominated by irrigated agriculture. With agricultural consumption reaching 90 percent of total water consumption in some areas, agricultural needs and the growing problem of salinity due to irrigation are major factors. The West now stands at a critical juncture. Except in small municipal irrigation are major factors. The West now stands at a critical juncture. Except in small municipal projects, supply-side remedies are no longer the answer to water scarcity. Making a smooth transition in the West from water development to water conservation and reallocation will require fundamental changes in long-held attitudes toward natural resources and man's dominion over them. (See also W89-02630) (VerNooy-PTT) W89-02631

GREAT AMERICAN DESERT TRANS-FORMED: ARIDITY, EXPLOITATION, AND IMPERIALISM IN THE MAKING OF THE MODERN AMERICAN WEST,

California Univ., Los Angeles.

N. Hundley. In: Water and Arid Lands of the Western United States. Cambridge University Press, New York. 1988. p 21-83, 207 ref.

Descriptors: *Water law, *Water rights, *Deserts, *Arid lands, *Semiarid lands, *History, *Water demand, *Water supply development, *Literature review, Economic development, Irrigation requirements, Water allocation, Municipal water, Water policy, Western United States, Urbanization, Industrial water, Water allocation.

Following the 1848 discovery of gold in California, the West developed rapidly, with attention focused primarily on precious metals in the mountains and stockgrowing and farming on the Great Plains and in the broad valleys of the far West. Over the next 50 years, modest but significant advances in irrigation accompanied important developments in western water law, especially in states containing both arid and humid sections. Western agriculture's hard times in the 1880s and 1890s were followed by unprecedented prosperity during the early twentieth century. Mining enjoyed similar prosperity during the way years, and governmental expenditures, along with advances in science and technology, were decisive. Both stockgrowers and farmers experienced boom times from growers and farmers experienced boom times from the 1940s into the 1960s, while urban and industrial expansion meant increased demands from the West's dearest resource: water. Pressure for mas-sive new water projects lessened in the 1970s and sive new water projects tessened in the 1970s and 1980s as costs soared, as environmentalists urged wiser use of scarce supplies, and as the population growth rate slowed. With a current western population in excess of 70 million, with increasing urban and industrial demands for limited water supplies,

Water Demand-Group 6D

and with little prospect of huge new projects to increase water supplies, the West is entering a new and with little prospect of huge new projects to increase water supplies, the West is entering a new era. The emphasis is now on reallocation and better management of existing supplies. Demands are mounting for new attitudes toward water, especially for conservation in agriculture. (See also W89-02630) (VerNooy-PTT)
W89-02632

CENTRAL VALLEY OF CALIFORNIA,

CENTRAL VALLEY OF CALIFORNIA, California Univ., Davis. C. V. Moore, and R. E. Howitt. IN: Water and Arid Lands of the Western United States. Cambridge University Press, New York. 1988. p 85-126, 2 fig, 10 tab, 26 ref.

Descriptors: *California, *Water demand, *Water management, *Water law, *Water allocation, *Water policy, Municipal water, Economic development, Overdraft, Water conveyance, History,

The conflicts and control of water in California have been the source of political careers, personal fortunes, and Hollywood movies. Water has char-acteristics of both public and private property. Over the past century, water management and development have shifted from small local institudevelopment have shifted from small local institu-tions to predominantly large public agencies. The impetus for changing institutions came from physi-cal, economic, and technical shifts; the implemen-tation was manifest political power. A brief over-view of the physical and economic characteristics of California's Central Valley is presented, fol-lowed by a historical overview of economic devellowed by a historical overview of economic deven-opment in the valley, including water law and the major actors in the development and management of water. Emerging problems in the Central Valley water industry are presented, and the policy solu-tions to these problems are developed. These con-clusions lead to the prediction that California's water institutions are about to change substantially seein. A postpructural policy option would transwater institutions are about to change substantially again. A nonstructural policy option would transform water agencies from predominantly builders and allocators of new supplies to providers of information and impartial brokers for existing supplies. Providing information to minimize the cost of market creation would replace construction of new facilities as the primary agency thrust. (See also W89-02630) (Author's abstract)

LAND AND WATER MANAGEMENT ISSUES:

TEXAS HIGH PLAINS, R. D. Lacewell, and J. G. Lee In: Water and Arid Lands of the Western United States. Cambridge University Press, New York. 1988. p 127-167, 3 fig, 3 tab, 59 ref.

Descriptors: *Groundwater mining, *Ogallala aq-uifer, *Texas, *Arid lands, *Water management, *Groundwater depletion, *Water conservation, *Water policy, Farm management, Dry farming, Irrigation effects, Irrigation requirements, Water use efficiency, Land management.

Irrigation developed on the Texas High Plains using water from an exhaustible groundwater resource (the Ogallala aquifer). Pumping from the Ogallala in this region has diminished the resource to the point that some areas have already made a transition back to rain-fed or dryland agricultural production. This transition from an intensive agriculture to an extensive one (irrigated to dryland agriculture). production. This transition from an intensive agriculture to an extensive one (irrigated to dryland) offers a unique opportunity for study in the United States, one that can provide lessons for other regions that eventually will face such a transition. The focus of this case study is the implications of aquifer mining. They include impacts on agriculture, soil erosion, and present policy options most likely to effect a smooth transition to dryland farming, considering mininging long-term envifarming, considering minimizing long-term envi-ronmental degradation as well as political and eco-nomic feasibility. Policy needs for resource conser-vation and orderly economic adjustment on the Texas High Plains include flexibility in commodity programs for cropping pattern changes, fine tuning of cost-sharing programs, targeting the conservation reserve program to maximize erosion control per dollar of federal expenditure, and research and education to develop new technology and improve

farming systems and to transfer information to the farmers. (See also W89-02630) (Author's abstract)

WATER RESOURCES OF THE UPPER COLO-RADO RIVER BASIN: PROBLEMS AND POLICY ALTERNATIVES,

Colorado Univ., Boulder C. W. Howe, and W. A. Ahrens.

In: Water and Arid Lands of the Western United States. Cambridge University Press, New York. 1988. p 169-232, 7 fig, 23 tab, 53 ref, append.

Descriptors: *Colorado River Basin, *Interstate rivers, *Arid lands, *Water policy, *Economic evaluation, *Water management, *Water law, Water allocation, Irrigation requirements, History, Water quality, Water demand.

The Colorado River is the major surface water resource of the Southwest, and its upper basin has an area of approximately 102,000 square miles. The legal and institutional history of the Upper Colorado Basin is reviewed, as well as the hydrology, water use patterns, and the value of water in its subbasins. Water quality issues and the potential for intrastate and interstate water markets involving the Upper Basin are also discussed. It is a major contention of this study that the Upper Basin is not and will not be short of water if the five states of the basin use their supplies in an economically reasonable way. A set of basinwide policy recommendations includes the establishment of an interstate river basin commission. At the state level, policy recommendations include introducing level, policy recommendations include introducing legislation to promote water conservation and modify salinity management programs. The real issues confronting the Colorado Basin are primarily institutional, not technical. More research, including actual experimentation, should be devoted critung actual experimentation, should be devoted to institutional-motivational design. A basinwide institution is needed to identify and negotiate optimal changes in water allocation and management for all parts of the basin. (See also W89-02630) (VerNooy-PTT) W89-02635

GROWTH AND WATER IN THE SOUTH COAST BASIN OF CALIFORNIA,

California Univ., Riverside.

IN: Water and Arid Lands of the Western United States. Cambridge University Press, New York. 1988. p 233-279, 6 fig. 10 tab, 34 ref.

Descriptors: *Water supply development, *Semi-arid lands, *Water demand, *Water management, *Water policy, Water rates, Water scarcity, Cali-fornia, Pricing.

The South Coast Basin of southern California includes the second largest urban area in the United States as well as the two largest cities in California, Los Angeles and San Diego. The modern history of the region has been characterized by the development of supplemental water supplies and the storage facilities necessary to regulate water flows storage facilities necessary to regulate water from so as to redress the natural imbalance between periods of peak supply and peak demand. The water supply agencies of the basin have predicted that, without additional supplies, historically prevailing rates of use cannot be sustained much beyond 1990. The reasons are the imminent decline in supplies available from the Colorado River and the anticipated continuation of population growth. the anticipated continuation of population growth. The inability to develop new supplies need not forestall continued growth or doom the residents of the South Coast Basin to progressively worsening water deprivation, however. Evidence suggests that the basin can adapt to intensifying water scarcity through changes in water pricing policies, development of institutions to facilitate market-like trade in water, or some combination of the two. Market-like trading would provide the South coast Basin with the opportunity to preserve water con-Basin with the opportunity to preserve water consumption rates at a relatively low cost. (See also W89-02630) (VerNooy-PTT) W89-02636

TOWARD SUSTAINING A DESERT METROP-OLIS: WATER AND LAND USE IN TUCSON, ARIZONA, Arizona Univ., Tucson. W. E. Martin, H. M. Ingram, D. C. Cory, and M. G. Welleg.

In: Water and Arid Lands of the Western United States. Cambridge University Press, New York. 1988. p 281-332, 6 fig, 7 tab, 40 ref, 2 append.

Descriptors: *Deserts, *Arid lands, *Water management, *Land use, *Tucson, *Arizona, *Water policy, *Municipal water, Water demand, Water allocation, Water conservation, Public opinion.

Arizona in general and Tucson in particular provide an opportunity to test against reality the extent to which a new age in water has already dawned and the degree to which the vestiges of previous patterns of decision making and policy continue. The statewide Arizona water problem and policy response, and water and land issues for the coming years were examined. Also reviewed is the Tucson Active Management Area (including the city of Tucson) and the politics of growth and water in Tucson. Appearances suggest that Tucson exemplifies the shift from water development to water management. Despite the appearance of change, however, many characteristics of traditional water policy, such as the same impetus toward growth and development, have survived. A characteristic of the previous development eraws that problems were not solved but instead passed on to the future. The current Arizona water policy also is passing problems on to the future. The likelihood of substantial policy and political change depends upon the extent to which the costs of current policy come to be percived. It is also possible that change may come about through the mobilization of a broad public concern about the present and future quality of life in the state and in Tucson. (See also W89-02630) (VerNooy-PTT) W89-02637

WATER MANAGEMENT ISSUES IN THE DENVER, COLORADO, URBAN AREA, Milliken Chapman Research Group, Inc., Little-

ton, CO J. G. Milliken.

In: Water and Arid Lands of the Western United States. Cambridge University Press, New York. 1988. p 333-375, 1 fig, 50 ref.

Descriptors: *Denver, *Municipal water, *Water management, *Water policy, *History, Water supply development, Water allocation, Water conservation, Water rates.

Water management issues have fundamentally shaped the laws, political and social institutions, economy, and culture of the residents of the Denver area since its beginnings. Since permanent settlement began in 1859, the successive waves of occupants have fought to conquer and shape the natural environment to their needs. These values are now being challenged by continued growth. The water supply system in the Denver metropolitan area comprises a system that began in the core city and graw outward to encompass a group of tan area comprises a system that began in the core
city and grew outward to encompass a group of
town systems. The political rancor that began with
water disputes between Denver and its suburbs in
the 1940s and 1950s continues to fragment water
policy in the metropolitan area and to hamper
formation of an effective regional growth management system. Water supply can be augmented or
water demand managed to alleviate the large water
shortage facing the Denver metropolitan area
during the next half-century in various ways.
Transmountain diversion, reallocation of agricultural water supplies, using groundwater, conserva-Transmountain diversion, reallocation of agricultural water supplies, using groundwater, conserva-tion measures, water pricing to reduce demand, and a regional growth management plan are all being examined. Although there is now much dis-agreement over the future direction of water management, in the next 2 or 3 years a systemwide environmental impact statement on the metropolitan Denver water supply system will be complete and the scenario decided upon to meet the Denver area's water needs for the next 50 years. (See also W89-02630) (VerNooy-PTT)

Field 6-WATER RESOURCES PLANNING

Group 6D-Water Demand

NEW WATER POLICIES FOR THE WEST, WATER PULICIES FUR THE WEST, World Resources Inst., Washington, DC. M. T. El-Ashry, and D. C. Gibbons. IN: Water and Arid Lands of the Western United States. Cambridge University Press, New York. 1988. p 377-395, 19 ref.

Descriptors: "Water policy, "Western United States, "Arid lands, "Semiarid lands, "Water management, "Water demands, Water allocation, Municipal water, Water conservation, Irrigation effects, Salinity, Agriculture, Water supply development, Return flow.

The arid West has entered a new era. What was once an endless frontier is now a vital, populated region fully integrated with the rest of the country. In light of emerging conflicts over water allocation and water quality degradation, western states must now re-evaluate their water management priorities. Agricultural water use is threatened not only by growing urban demand, but also by soil and water salinity and toxic return flows, which highlight the negative environmental impacts of traditional irrinegative environmental impacts of traditional irri-gation practices. The time-honored strategy of increasing water supplies and correcting water qual-ity degradation through capital-intensive projects has reached its limits; financial, environmental, and has reached its limits; financial, environmental, and legal obstacles are overwhelming. Growing cities that have already instituted marginal cost pricing but still need more water should follow least-cost rules in choosing between new water supply projects and such alternatives as purchase or lease of water from agriculture or demand-reduction programs. As a natural response to water markets, higher water use efficiency in irrigated agriculture makes more water available and has many positive environmental consequences - reduced saline and toxic return flows from irrigation, and augmented supplies for recreation or waste dilution. Overall. supplies for recreation or waste dilution. Overall, the new water policies presented are based on the premise that arid and semiarid regions are going to have to live within their limited water budgets. These recommendations also stem from the realiza-These recommendations also stem from the realiza-tion that many of the traditional water policies no longer serve the public interest and do not meet the new challenges of urbanization and environ-mental degradation. The West needs to act now, before crises govern the management of this vital resource. (See also W89-02630) (VerNooy-PTT) W89-02639

CONJUNCTIVE USE OF SURFACE AND GROUND WATER IN THE SOUTH PLATTE, RIVER BASIN: A CASE STUDY OF THE CENTRAL COLORADO WATER CONSERVANCY DISTRICT, Central Colorado Water Conservancy District,

Greeley.
T. V. Cech.
IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p
47-56, 12 ref.

Descriptors: *Conjunctive use, *Surface water, *South Platte River, *Water law, *Groundwater, *Colorado, Water conservation, Water quality, Water use efficiency, Case studies.

The mainstream South Platte River and its tribu-The mainstream South Platte River and its tribu-taries exhibit wide variation in water quality char-acteristics. Most streams in the upstream part of the basin have small dissolved solids concentra-tions, providing excellent stream quality for most water uses. Water quality declines in the South Platte as it flows through the metropolitan Denver area, probably due to municipal and industrial wastewater discharges and nonpoint source contributions such as lawn irrigation and urban runoff. outlons such as nawn irrigation and urban runori.
Agricultural return flows and runoff from feed lots have affected water quality downstream of Denver. Large concentrations of nitrogen and phosphorous have been measure in the area in the phosphorous have been measure in the area in the South Platte River and in the adjacent aquifer. The existence of large amounts of dissolved solids and existence of large amounts of dissolved solids and sulfates have created some problems for down-stream municipal and domestic water supplies. Degradation of ground water has been noted in several areas of the basin. Dissolved solids concen-trations in alluvial ground water are consistently greater than average concentrations in the adjacent South Platte River. Ground water administration

in Colorado has developed into a complex network of permits, hearings, and legal doctrine. With the continued competition for water along the Front Range of the state, entities with large water demands and sizable revenues, cities, will be best able to continue to develop and acquire valuable water rights. The implications for the ground water irrigators are great. Not only will they continue to be required to pay for augmentation water to offset the depletion of the river caused by out-of-priority pumping, but they will also be charged higher and higher fees to acquire such water for augmentation. The physical allocation and administrative tools of ground water in Colorado are in place, but the economic effects of the existing system may be tools of ground water in Colorado are in pace, our the economic effects of the existing system may be devastating to the ground water irrigator of the future. (See also W89-02654) (Davis-PTT)

NATURAL FLOW AND WATER CONSUMP-TION IN THE MILK RIVER BASIN, MON-TANA AND ALBERTA, CANADA,

Geological Survey, Reston, VA. Water Resources

For primary bibliographic entry see Field 2E. W89-03004

6E. Water Law and Institutions

USE OF A REGIONAL GROUND-WATER FLOW MODEL FOR WATER RIGHTS ADMINISTRATION IN A SOUTHWEST ALLUVIAL

New Mexico State Engineer Office, Santa Fe. For primary bibliographic entry see Field 4B. W89-02332

IMPLICATIONS OF THE CLEAN WATER ACT IMPLICATIONS OF THE CLEAN WATER ACT AND SAFE DRINKING WATER ACT LEGISLA-TION FOR SOUTHWESTERN INDIAN TRIBES: WATER-QUALITY MANAGEMENT AND INDIAN SELF DETERMINATION, Bureau of Indian Affairs, Albuquerque, NM. Albu-

querque Area Office.
For primary bibliographic entry see Field 5G.
W89-02334

IMPACTS OF RECHARGE LEGISLATION ON GROUNDWATER MANAGEMENT IN ARIZO-

Arizona Dept. of Environmental Quality, Phoenix. For primary bibliographic entry see Field 4B. W89-02336

LIABILITY FOR MANAGING HAZARDOUS WASTES: PAST, PRESENT AND FUTURE, Wolf, Block, Schorr and Solis-Cohen, Philadel-

phia, PA. M. E. Gold.

IN: 8th AESF/EPA Conference on Pollution Control for the Metal Finishing Industry. EPA Report No. EPA/600/9-87/012, July 1987. p 77-87, 38 ref.

Descriptors: *Superfund, *National Contingency Plan, *Legislation, *Regulations, *Water pollution prevention, *Environmental protection, *Clean Air Act, *Safe Drinking Water Act, *Toxic Sub-stances Control Act, *Resource Conservation and Recovery Act, Hazardous waste program, Liability, Water pollution treatment.

The current legal framework applicable to the handling of hazardous substances and wastes focuses on the complex regulatory program governing hazardous wastes and present disposal practices as well as the theories of liability available to address improper past disposal practices. Topics discussed are: (1) The Clean Air Act of 1970; (2) The Safe Drinking Water Act of 1974; (3) The Toxic Substances Control Act of 1976; (4) The Resource Conservation and Recovery Act of 1976; (5) The Hazardous Waste Program; (6) Superfund; and (7) National Contingency Plan. (See also W89-02392) (Lantz-PTT) 02392) (Lantz-PTT) W89-02398

ENVIRONMENTAL AUDITING: MANAGE-MENT'S KEY TO EFFECTIVE ENVIRONMEN-TAL COMPLIANCE,

Mabbett, Capaccio and Associates, Inc., Cambridge, MA. For primary bibliographic entry see Field 6A. W89-02409

WATER AND ARID LANDS OF THE WEST-ERN UNITED STATES.

For primary bibliographic entry see Field 6D. W89-02630

WEST IN PROFILE, World Resources Inst., Washington, DC. For primary bibliographic entry see Field 6D. W89-02631

GREAT AMERICAN DESERT TRANS-FORMED: ARIDITY, EXPLOITATION, AND IMPERIALISM IN THE MAKING OF THE MODERN AMERICAN WEST,

California Univ., Los Angeles. For primary bibliographic entry see Field 6D. W89-02632

CENTRAL VALLEY OF CALIFORNIA.

California Univ., Davis.
For primary bibliographic entry see Field 6D.
W89-02633

WATER RESOURCES OF THE UPPER COLORADO RIVER BASIN: PROBLEMS AND POLICY ALTERNATIVES,

Colorado Univ., Boulder. For primary bibliographic entry see Field 6D. W89-02635

GROWTH AND WATER IN THE SOUTH COAST BASIN OF CALIFORNIA,

California Univ., Riverside.
For primary bibliographic entry see Field 6D.
W89-02636

TOWARD SUSTAINING A DESERT METROP-OLIS: WATER AND LAND USE IN TUCSON, ARIZONA, Arizona Univ., Tucson.

For primary bibliographic entry see Field 6D. W89-02637

WATER MANAGEMENT ISSUES IN THE DENVER, COLORADO, URBAN AREA, Milliken Chapman Research Group, Inc., Little-

ton, CO. For primary bibliographic entry see Field 6D. W89-02638

NEW WATER POLICIES FOR THE WEST,

World Resources Inst., Washington, DC. For primary bibliographic entry see Field 6D. W89-02639

U.S.D.A. AGRICULTURAL RESEARCH SERVICE COMMITMENT TO GROUND WATER RESEARCH,

Agricultural Research Service, Bushland, TX. For primary bibliographic entry see Field 3F. W89-02655

CONJUNCTIVE USE OF SURFACE AND GROUND WATER IN THE SOUTH PLATTE, RIVER BASIN: A CASE STUDY OF THE CENTRAL COLORADO WATER CONSERVANCY DISTRICT,

Central Colorado Water Conservancy District, For primary bibliographic entry see Field 6D.

Water Law and Institutions—Group 6E

INCENTIVES AND INSTITUTIONS TO REDUCE PESTICIDE CONTAMINATION OF GROUND WATER, California Univ., Berkeley. Dept. of Agricultural and Resource Economics. For primary bibliographic entry see Field 5G. W89-02677

DEVELOPING A STATE GROUND WATER POLICY IN THE CORN BELT: THE IOWA CASE,

Tr Corp., Monroeville, PA.
For primary bibliographic entry see Field 2F.
W89-02681

ANNUAL REPORT, 1986 (RESERVOIR CONTROL CENTER, SOUTHWESTERN DIVISION, U.S. ARMY CORPS OF ENGINEER).

Army Engineer Div. Southwestern, Dallas, TX. For primary bibliographic entry see Field 4A. W89-02716

INSTITUTIONAL AND POLICY CONTEXT, Middlesex Polytechnic, London (England). Flood Hazard Research Centre. For primary bibliographic entry see Field 6F. W89-02746

URBAN FLOOD PROBLEMS: THEIR SCALE AND THE POLICY RESPONSE, Ministry of Agriculture, Fisheries and Food, London (England). For primary bibliographic entry see Field 4A. W89-02746

POWER BEHIND THE FLOOD SCENE, Middlesex Polytechnic, London (England). Flood Hazard Research Centre.

E. C. Penning-Rowsell.

IN: Flood Hazard Management: British and International Perspectives. Geo Books, Norwich, England. 1987. p 61-73, 2 fig, 14 ref.

Descriptors: *Flood plain management, *Decision making, *Flood plain zoning, *Policy analysis, Project planning, Management planning, Cost analysis, Great Britain, Institutional constraints, Political aspects, Evaluation, Urban planning.

Some of the influences upon decision-making con-cerning urban flood alleviation schemes in Britain are reviewed and some of the problems of objec-tive and rigorous policy analysis are analyzed. It is suggested that there are certain structural forces which dominate the policy-making and decision-making system, including the institutional arrange-ments which form the context and the national ments which form the context and the national economic and political trends which determine the resources available for public sector infrastructure investment. The complete domination of policymaking by these structural forces is rejected, however, and certain local mediating forces are reviewed which are seen to affect the evolution of events. These include the quality of the staff involved, the hierarchical structures within which individuals operate, and the standard procedures used within this field. The process of innovationadoption is seen as slow, and consultants are seen as influencing the process to a significant if not an excessive extent. More fundamentally, it is shown that all those involved in project appraisal have an excessive extent. More fundamentary, it is snown that all those involved in project appraisal have an interest in maximizing investment levels, which can mean that economic appraisal becomes mere post-rationalization of predetermined decisions. (See also W89-02743) (Author's abstract) W89-02747

DEVELOPMENT CONTROL PROCEDURES IN ENGLAND AND WALES, Wessex Water Authority, Poole (England). For primary bibliographic entry see Field 6F. W89-02748

CONFLICTING OBJECTIVES IN FLOOD-PLAIN MANAGEMENT: FLOOD DAMAGE REDUCTION VERSUS HERITAGE PRESER-

Waterloo Univ. (Ontario). Dept. of Geography. For primary bibliographic entry see Field 6F. W89-02749

FLOOD INSURANCE AND FLOODPLAIN MANAGEMENT, Institute of Hydrology, Wallingford (England). For primary bibliographic entry see Field 6F. W89-02750

DESIGN STANDARDS FOR BUILDING IN FLOOD HAZARD AREAS: A CRITICAL LOOK AT US EXPERIENCE AND POSSIBLE APPLICATIONS ABROAD,

Kusler (J. A.) Associates, Chester, VT. For primary bibliographic entry see Field 4A. W89-02751

FLOOD LOSS REDUCTION BY METROPOLI-TAN REGIONAL AUTHORITIES IN THE

Massachusetts Univ., Amherst. Dept. of Geology and Geography. R. H. Platt

IN: Flood Hazard Management: British and International Perspectives. Geo Books, Norwich, England. 1987. p 143-159, 3 fig, 10 ref.

Descriptors: *Urban areas, *Flood control, *Flood damage, *Flood plain management, *Flood protection, Floodproofing, Case studies, Urban planning, Local governments, Management planning.

The broadening of the range of functional response to floods is hampered by the constraints of the traditional dichotomy of national versus local authority, the two levels of government traditionally most involved with flood mitigation. Both the fedmost involved with flood mitigation. Both the federal government and local community are ill-suited geographically and politically to the challenge of devising complex and creative solutions to flood hazards at the metropolitan scale. The initiative for responding to urban flood hazards is increasingly shifting to the scale of the metropolitan region itself. However, the emerging importance of metropolitan government in flood hazard management has been somewhat obscured by the tendency to equate them with local communities. This chapter examines three regional bodies of considerable importance: the Metropolitan Sanitary District of Greater Chicago, the Denver Urban Drainage and Flood Control District, and the Harris County Flood Control District, (See also W89-02743) (Author's abstract) thor's abstract) W89-02752

FLOOD WARNING DISSEMINATION: THE BRITISH EXPERIENCE, Middlesex Polytechnic, London (England). Flood Hazard Research Centre. For primary bibliographic entry see Field 6F. W89-02753

WARNING DISSEMINATION AN SPONSE WITH SHORT LEAD TIMES, AND RE-SPUNSE WITH SHORT LEAD TIMES, Colorado Univ. at Colorado Springs. Dept. of Geography and Environmental Studies. For primary bibliographic entry see Field 6F. W89-02754

FLOODPLAIN MAPPING AND BEYOND: A STATE PERSPECTIVE,
Maryland Water Resources Administration, Annapolis. Flood Management Div.
For primary bibliographic entry see Field 6F.
W89-02755

PROJECT APPRAISAL, RESOURCE ALLOCA-TION AND PUBLIC INVOLVEMENT,

TION AND PUBLIC INVOLVEMENT, Bayerisches Landesamt fuer Wasserwirtschaft, Munich (Germany, F.R.). R. F. Schmidtke. IN: Flood Hazard Management: British and International Perspectives. Geo Books, Norwich, England. 1987. p 263-278, 7 ref, append.

Descriptors: *Project planning, *Flood plain management, *Resource allocation, *West Germany, *Public participation, Decision making, Evaluation, Surveys, Social aspects, Future planning, Management planning.

Management planning.

The latest thinking, approaches and experiences of the Federal Republic of Germany to overcome the problems of water resource allocation are presented. A short overview of the changed conditions under which water resources planning and decision-making have to take place is described. From this platform a set of requirements are derived concerning the contents and organization of the planning process. Systematic planning activities have to cover four functional planning tasks: problem identification, formulation of all leasible alternatives, impact analyses, and evaluation. The successful execution of these tasks implies an appropriate organizational form. Some key concepts are: a multidisciplinary team; iterative and interactive procedures including inter-institutional and public participation/consultation; and co-operation between planner and decision-maker. Many plans fail completely even when at a very advanced stage because of lack of communication between these key groups. Also attention must be devoted to both the managerial and technical issues. Application of assessment techniques early in the development stage of plan formulation has shown that they are excellent vehicles to set in motion the interactive planning process. The canabilities of these analytiexcellent vehicles to set in motion the interactive planning process. The capabilities of these analyti-cal tools are described based on practical experi-ence. (See also W89-02743) (Author's abstract) W89-02758

PRETREATMENT OF INDUSTRIAL WASTEWATER: LEGAL AND PLANNING ASPECTS-A CASE STUDY,

Karlsruhe Univ. (Germany, F.R.). Inst. fuer Sied-lungswasserwirtschaft. For primary bibliographic entry see Field 5D. W89-02800

CLEAN TECHNOLOGY IN THE NETHER-LANDS: THE ROLE OF THE GOVERNMENT. Rijksinstituut voor Zuivering van Afvalwater, Le lystad (Netherlands).

For primary bibliographic entry see Field 5G. W89-02801

SUPPLEMENTAL FINAL DEVELOPMENT DOCUMENT FOR EFFLUENT LIMITATIONS GUIDELINES, NEW SOURCE PERFORMANCE STANDARDS AND PRETREATMENT STANDARDS FOR THE LEATHER TANNING AND FINISHING POINT SOURCE CATEGO-

Environmental Protection Agency, Washington, DC. Industrial Technology Div. Available from the National Technical Information Service, Springfield, VA 22161, as PB88-213341. Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA 440/1-88-016-S, February 1988. 100p, 1 fig, 40 tab, 4 append.

Descriptors: *Standards, *Tannery wastes, *Legis-lation, *Water quality standards, *Wastewater treatment facilities, Regulations, Sulfides, Chromi-um, Effluents, Industrial wastewater.

the EPA is amending 40 CFR Part 425 which limits effluent discharges to waters of the United States and the introduction of pollutants into publicly owned treatment works (POTW) by existing and new sources engaged in leather tanning and finishing. EPA agreed to promulgate these amendments in a settlement agreement with the Tanners' Council of America, Inc. These amendments include: (1) a new analytical method for the determination of the presence of sulfide in wastewater for use in the Hair Save or Pulp, Non-Chrome Tan, Retan-Wet Finish Subcategory (subcategory 3); (2) clarification of procedural requirements for POTW to follow in determining whether sulfide pretreatment standards are applicable; (3) revisions to certain of the effluent limitations guidelines for 'best practicable control technology currently available' (BPT) and new source performance standards

Field 6-WATER RESOURCES PLANNING

Group 6E-Water Law and Institutions

(NSPS); (4) a change in the pH pretreatment standard for tanneries falling under the provisions of the Hair Save or Pulp, Non-Chrome Tan, Retan-Wet Finish Subcategory (Subpart C of 40 CFR Part 425); and (5) clarification of the production levels below which the chromium pretreatment standards for existing sources (PSES) do not apply. In addition, in the preamble to the promulgated amendments to 40 CFR Part 425, EPA clarifies its statements on median water use ratios, changes in subments to 40 CPF ratt 42.5, EPA citatines its state-ments on median water use ratios, changes in sub-categorization, tanneries with mixed subcategory operations, and composite samples of effluent dis-charges from multiple outfalls. These issues are addressed in Section VIII. (Lantz-PTT) W89-02832

NATIONAL ACID PRECIPITATION ASSESS-MENT PROGRAM: ANNUAL REPORT, 1986. National Acid Precipitation Assessment Program, Washington, DC. Office of the Director of Research.

For primary bibliographic entry see Field 5B. W89-02873

WATERTOWN, MINNESOTA: PROOFING INFORMATION. Army Engineer District, St. Paul, MN. FLOOD For primary bibliographic entry see Field 6F. W89-02939

RIVER CONSERVATION - IMPLICATIONS RIVER CONSERVATION - INFLICATIONS FOR LEGISLATION, Rhodes Univ., Grahamstown (South Africa). Dept. of Geography. A. W. Stone, S. Lane, W. B. Russell, and H. J. IN: Conservation of South African Rivers. 1986. p 74-87, 28 ref.

Descriptors: *Water conservation, *Legislation, *Rivers, *South Africa, Management planning, Standards, Regulations

Present demands for the resources of South Afri-Present demands for the resources of South African rivers have put severe strains on river systems. In order to maximize the benefits of river systems for the present and future population of South Africa there must be effective control, management and education in all aspects of the hydrological environment. cal environment. There is therefore a need for careful planning and effective management. Legis-lation provides the framework for all decisionmaking related to abstraction, engineering works, and the allocation of water resources. Acts of parliament relating to rivers, aspects of management and conservation of rivers covered by existinent and conservation of news covered by exist-ing legislation, suggestions for additional legisla-tion and/or consolidation of existing legislation, shortcomings in the administration and application of existing legislation, aspects relating to the effective management and conservation of rivers not covered by existing legislation, and suggestions for administrative changes necessary to achieve effec-tive enforcement of existing legislation are all out-lined. chapter. (See also W89-02985) (Lantz-PTT) W89-02992

ENVIRONMENTAL MANAGEMENT OF THE ZAMBEZI RIVER SYSTEM, Ministry of Agriculture and Water Development, Lusaka (Zambia).

nary bibliographic entry see Field 5G. For primar W89-03144

ATTEMPT TO FACILITATE WATER MAN-AGEMENT ISSUES IN THE ZAMBEZI RIVER BASIN USING DECISION SUPPORT SYS-TEMS.

International Inst. for Applied Systems Analysis, Laxenburg (Austria). For primary bibliographic entry see Field 5G. W89-03145

6F. Nonstructural Alternatives

FLOOD HAZARD MANAGEMENT: BRITISH AND INTERNATIONAL PERSPECTIVES,

For primary bibliographic entry see Field 4A. W89-02743

INSTITUTIONAL AND POLICY CONTEXT. Middlesex Polytechnic, London (England). Flood Hazard Research Centre. D. J. Parker.

D. J. Parker.
In: Flood Hazard Management: British and International Perspectives. Geo Books, Norwich, England. 1987. p 35-52, 3 fig, 4 tab, 28 ref.

Descriptors: *Flood plain management, *Flood plain zoning, *Flood control, Policy making, Urban planning, Land use, Project planning, Research priorities, Management planning, England, Wales, Institutional constraints.

Some of the principal features of flood hazard institutions and policies in England and Wales are explained. Urban flood hazard administration is explained. Urban flood hazard administration is closely related to agricultural land drainage policy, reflecting the history of British flood mitigation practice. Flood hazard mitigation is supervised by the Ministry of Agriculture, Fisheries and Food and by the ten Water Authorities. Riverine and coastal flood mitigation works receive central government grant aid. Flood mitigation strategies are not solely structural: flood warning services and an advisory system of floodplain development control are long established non-structural strategies. The second section of this chapter questions whether the nature of the flood hazard problem in Britain has yet been defined, and whether current policies are most appropriate. Some critical comments are offered on research inadequacies including the lack ordered on research madequacies including the lack of data performance of flood mitigation measures. Flood loss potential assessment is identified as a strength of British research. (See also W89-02743) (Author's abstract) W89-02745

DEVELOPMENT CONTROL PROCEDURES IN ENGLAND AND WALES, Wessex Water Authority, Poole (England).

R. Burch

IN: Flood Hazard Management: British and International Perspectives. Geo Books, Norwich, England. 1987. p 81-97, append.

Descriptors: *Flood plain zoning, *Flood plain management, *England, *Wales, Project planning, Management planning, Flood control, Land use, Urban planning, Flood damage, Design criteria.

Control of flood plain development in Britain is not founded on national standards, or at the local level on strict zoning laws. Instead it is based on an essentially voluntary system of consultation between water authorities and planning authorities. The system is consistent with the United Kingdom procedure in certain other fields where different aspects of the public interest must be balanced. aspects of the public interest must be outained.
The development control system is examined by reviewing its operation in the Avon and Dorset Division of Wessex Water Authority. The application of the development control guidance provided. tion of the development control guidance provined by central government is discussed in terms of location and type of development. The point is made that the availability of good floodplain data is of utmost importance if the development control system is to continue to work effectively. (See also W89-02742) (Author's abstract)

CONFLICTING OBJECTIVES IN FLOOD-PLAIN MANAGEMENT: FLOOD DAMAGE REDUCTION VERSUS HERITAGE PRESER-

VATION, Waterloo Univ. (Ontario). Dept. of Geography.

IN: Flood Hazard Management: British and International Perspectives. Geo Books, Norwich, England. 1987. p 99-116, 13 ref, append.

Descriptors: *Nonstructural alternatives, *Flood plain zoning, *Flood plain management, *Urban planning, Flood damage, Canada, Social aspects, Economic aspects, Land use, Future planning, Case studies, Management planning, Flood con-trol

Social scientists often argue that greater use should be made of non-structural adjustments in flood-plain management. Specifically, public acquisition of flood plain land in urban areas for development of flood plain land in urban areas for development as permanent open space is frequently advocated as one of the most effective long-term strategies to reduce flood damages. However, public acquisition of floodplain land in communities can create conflicts with other societal objectives. Where public land acquisition is perceived to sterilize land regarding its potential to generate tax revenue for a community, advocates of economic development oppose it. Where public land acquisition involves the purchase and demolition of historically or architecturally significant buildings, advocates of the purchase and demonition of instoricary or ar-chitecturally significant buildings, advocates of heritage preservation oppose it. Experience in three Ontario communities (St. Marys, Port Hope and Cambridge-Galt) illustrates that public land and Cambridge-Galt) illustrates that public land acquisition as a flood damage reduction adjustment is not always as viable a strategy as social scientists maintain. If public land acquisition is to be used as a non-structural adjustment, it must be implemented in a manner which recognizes and accommodates concern with economic development and heritage preservation. (See also W89-02743) (Author's abstract)

FLOOD INSURANCE AND FLOODPLAIN MANAGEMENT,

Institute of Hydrology, Wallingford (England). N. W. Arnell

N. W. Arnell.
IN: Flood Hazard Management: British and International Perspectives. Geo Books, Norwich, England. 1987. p 117-133, 1 tab, 45 ref.

Descriptors: *Flood insurance, *Flood plain zoning, *Great Britain, *Flood plain management, zoning, "Great Britain, "Flood plain management, Economic aspects, Flood damage, Flood control, Management planning, Surveys, Floodproofing, England, Wales, Flood protection, Comparison studies, United States, Nonstructural alternatives.

Although the primary role of flood insurance must be to facilitate recovery from flood loss, it is possible in principle to integrate flood insurance into more general flood plain management strate-gies. Flood insurance lies at the heart of federal initiatives in flood plain management in the United States, where it is used as a bait to encourage local communities to adopt flood plain regulations. In Britain, however, flood insurance is sold directly Britain, nowever, nood insurance is sooi directly by the private insurance industry, and plays no part in wider floodplain management. This paper reviews the provision of flood insurance in both the United States and Britain, with particular reference to actual and potential links with flood loss reduction. (See also W89-02743) (Author's abstract) W89-02750

DESIGN STANDARDS FOR BUILDING IN FLOOD HAZARD AREAS: A CRITICAL LOOK AT US EXPERIENCE AND POSSIBLE APPLI-CATIONS ABROAD,

Kusler (J. A.) Associates, Chester, VT. For primary bibliographic entry see Field 4A. W89-02751

FLOOD WARNING DISSEMINATION: THE BRITISH EXPERIENCE,
Middlesex Polytechnic, London (England). Flood

Hazard Research Centre. D. J. Parker

IN: Flood Hazard Management: British and International Perspectives. Geo Books, Norwich, England, 1987. p 169-190, a fig, 33 ref, append.

Descriptors: *Warning systems, *Great Britain, *Flood plain management, *Flood forecasting, Evaluation, Management planning, Flood damage, Project planning, England, Nonstructural alterna-tives, Model studies, Performance evaluation.

The development of flood forecasting and warning services in Britain where warning lead times are short is discussed. Despite the progressive improvement of forecasting capability flood warning failures continue, largely because of weaknesses in

Ecologic Impact Of Water Development—Group 6G

the dissemination phase of the warning process which is briefly analyzed using the Williams and Foster models. Nevertheless, for a variety of reasons which are discussed, flood warning dissemination receives less attention than desirable. An evaluation of the flood warning dissemination practices in the Seven Trent Water Authority area is explained. This evaluation led to nine sets of recommendations of the contraction of the sets of recommendations of the contraction of the sets of recommendations. plained. This evaluation led to nine sets of recommendations for improving the Authority's flood warning dissemination practices. Flood warning dissemination problems arise from institutional weaknesses as much as from technical obstacles. The reasons for flood warning failures requires research in Britain perhaps focussing initially on consumer perceptions. Research is also required into warning message wording and the effect of pre-flood publicity. (See also W89-02743) (Author's abstract)
W89-02753

WARNING DISSEMINATION AND RE-SPONSE WITH SHORT LEAD TIMES, Colorado Univ. at Colorado Springs. Dept. of Geography and Environmental Studies. E. Gruntfest. IN: Flood Hagana

Discrimination of the Property
Descriptors: *Warning systems, *Flood forecast-ing, Social aspects, Flood damage, Flood plain management, Management planning, Flash floods, Research priorities, Nonstructural alternatives.

More public investments aim to improve flood forecasting capability than to evaluate the impact the predictions have on reducing loss of life or property damages. Floor dwarning systems are non-structural measures which can effectively reduce loss of life and mitigate damages from flooding. Flood warning and preparedness programs can assist in overall water management in non-flood periods and be a core for other disaster preparedness plans. In the United States, more attention has gone to flood recognition and warning and less consideration to development of formal response plans. The U.S. National Weather Service routinely issues specific forecasts of flood stages for about plans. The U.S. National Weather Service routine-ly issues specific forecasts of flood stages for about 2,300 locations. Many flood response programs in the United States rely on volunteers instead of government agencies or other institutional frame-works. Public response to warnings is not likely to be high immediately after initiation of a flood warning system if no special publicity efforts are mounted. Important warning and dissemination characteristics to ensure effective response to floods are enumerated. Some individual traits and characteristics to ensure effective response to floods are enumerated. Some individual traits and warning characteristics which affect response to flood warnings include: prior experience with floods, age, group context, education, sex, personality, and material wealth. Some social science principles which underlie warning efforts are discussed. Challenging research questions for continuing investigation include the establishment of more specific timeframes for flood warnings, determination of reaction to false alarms, and more accurate determination of costs and benefits in warning and warnings response. (See also W89-02743) (Geiger-PTT) W89-02754

FLOODPLAIN MAPPING AND BEYOND: A STATE PERSPECTIVE.

Maryland Water Resources Administration, Annapolis. Flood Management Div.

M. M. Whilden.

IN: Flood Hazard Management: British and International Perspectives. Geo Books, Norwich, England. 1987. p 209-218, 2 fig.

Descriptors: *Flood plain management, *Mapping, *Flood plain zoning, Management planning, Flood damage, Watershed management, Flood forecasting, Floodproofing, Risks, Nonstructural alternatives, United States, Federal jurisdiction, Local

Accurate risk identification is a first step in flood hazard alleviation. To this end the United States Federal Government has funded floodplain map-ping for use as the basis of local flood hazard

management throughout the country. It is a funda-mental part of the United States approach to flood alleviation that management is best achieved at the local level of government. Once the flood problem has been identified by floodplain maps, effective hazard management involves three major themes: control of future development; management of existing flood damage potential; and comprehensive watershed management to avoid increasing the physical flood risk. (See also W89-02743) (Author's abstract) W89-02755

SOURIS RIVER BASIN PROJECT, SASKATCH-EWAN, CANADA - NORTH DAKOTA, U.S.A. GENERAL PLAN REPORT AND DRAFT ENVI-RONMENTAL IMPACT STATEMENT.

Army Engineer District, St. Paul, MN. For primary bibliographic entry see Field 8A. W89-02937

WATERTOWN, MINNESOTA: PROOFING INFORMATION. FLOOD

Army Engineer District, St. Paul, MN Available from the National Technical Information Service, Springfield, VA 22161, as AD-A191 181. Price codes: A06 in paper copy, A01 in microfiche. March 1986. 57p, 11 fig, 39 photos.

Descriptors: *Watertown, *Flood protection, *Regulations, Permits, Flood control, Construction, Flood plain management.

A document was developed at the request of the city of Watertown, Minnesota, to present some conceptual solutions to flood proofing problems of structures in the city's floodplain, and provides some general concepts of flood proofing based on a tour of the problem structures. State law and the city floodplain ordinance require that detailed plans and specifications be prepared by a licensed engineer or architect prior to issuance of a building permit for construction of flood proofing features. This report does not satisfy the requirement for detailed plans and specifications of flood proofing designs. Before the concepts presented can be implemented, they must be developed into detailed plemented, they must be developed into detailed plans and specifications, after more detailed inspec-tions of the problem structures are conducted. (Author's abstract) W89-02939

RISING LEVEL OF THE GREAT SALT LAKE: IMPACTS AND ADJUSTMENTS.

National Center for Atmospheric Research, Boulder, CO.

P. M. Morrisette.

Bulletin of the American Meterological Society BAMIAT, Vol. 69, No. 9, p 1034-1040, September 1988. 5 fig, 23 ref. NSF Grant ATM-8409007.

Descriptors: *Water level fluctuations, *Water policy, *Great Salt Lake, Flooding, Climatology, Water management, Management planning.

The recent case of the rising level of the Great Salt Lake indicates that resource managers are often unprepared to respond to climate-related impacts, except in an ad hoc and costly fashion. Precipita-tion in the Great Salt Lake drainage basin between 1982 and 1986 averaged 134% of normal, resulting in a rise in the level of the Great Salt Lake of 3.66 m to a new historic record high level of 1283.77 m. This rise in the level of the lake has had widespread adverse impacts, forcing resource managers to implement costly emergency flood mitigation measures. Policy makers, however, have been unwilling to implement long-term policies aimed at adapting to fluctuating lake levels, relying instead of crisis management while hoping that the lake will soon recede. The water level of the Great Salt Lake, its impacts and adjustments, and an assess-ment of the long-term adjustment options are dised. (Author's abstract) W89-03127

6G. Ecologic Impact Of Water Development

LIMNOLOGICAL AND FISHERY STUDIES ON LAKE SHARPE, A MAIN-STEM MISSOU-RI RIVER RESERVOIR, 1964-1975, Fish and Wildlife Service, Washington, DC. For primary bibliographic entry see Field 2H. W89-02423

PHYSICAL, CHEMICAL, AND BIOLOGICAL CHARACTERISTICS OF LAKE SHARPE, SOUTH DAKOTA, 1966-1975, Fish and Wildlife Service, Pierre, SD. North Cen-tral Reservoir Investigations. For primary bibliographic entry see Field 2H. W89-02424

ZOOPLANKTON BIOMASS EXCHANGE IN LAKE SHARPE, SOUTH DAKOTA, 1974-1975, Fish and Wildlife Service, Pierre, SD. North Cen-tral Reservoir Investigations. For primary bibliographic entry see Field 2H. W89-02425.

DESIGN PROBLEMS IN GRAVEL-BED RIVERS, ALASKA, Harza Engineering Co., Chicago, IL. For primary bibliographic entry see Field 2J. W89-02458

GROUNDWATER WITHDRAWALS AND CHANGES IN GROUNDWATER QUALITY AND LAND SURFACE SUBSIDENCE IN THE HOUSTON DISTRICT, TEXAS,
Geological Survey, Houston, TX. Water Re-

Geological Survey, Houston, 1-A. Water Resources Div.

J. F. Williams, and C. E. Ranzau.

Available from OFS, 1605, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 87-4153, 1987. 56p, 28 fig. 8 tab, 33 ref.

Descriptors: *Geohydrology, *Groundwater pol-lution, *Water levels, *Water table, *Subsidence, *Groundwater, *Water-level fluctuations, *Land subsidence, *Texas, Withdrawal, Water quality, Observation wells, Harris County, Galveston County, Fort Bend County, Galveston, Chicot aq-uifer, Evangeline aquifer, Jasper aquifer.

During 1980-84, groundwater withdrawals from the Chicot and Evangeline aquifers in the Houston district decreased from 511 million gallons per day district decreased from 511 million gallons per day to 444 million gallons per day. The Houston area had the largest decreases in groundwater withdrawal. Water levels generally rose in the eastern part of the Houston district and declined in the western part from spring 1980 to spring 1985. The rise of water levels in wells in the Chicot and Evangeline aquifers was as much as 80 feet and 60 feet, respectively. The decline of water levels in wells in the Chicot and Evangeline aquifers was as much as 40 feet and 80 feet, respectively. In 1980, chloride concentrations in water from the Chicot aquifer ranged from 250 to 790 milligrams per liter, whereas in 1984, chloride concentrations ranged from 180 to 710 milligrams per liter. The concenfrom 180 to 710 milligrams per liter. The concentrations of chloride and dissolved solids in water trations of chloride and dissolved solids in water from the Evangeline aquifer remained less than 100 milligrams per liter and 500 milligrams per liter during 1980-84. Land subsidence is still evident in the Houston district. In general, subsidence rates between 1980 and early in 1985 in the eastern and southeastern parts of the Houston district are less than they were during 1975-79. However, subsidence rates in the western, southwestern, and northern parts of the Houston district during 1980 to early 1985 increased from the 1975-79 rates. (USCS) early 1985 (USGS) W89-02519

WATER QUALITY OF CANYON LAKE, CEN-

Geological Survey, Austin, TX. Water Resources For primary bibliographic entry see Field 2H.

Field 6-WATER RESOURCES PLANNING

Group 6G-Ecologic Impact Of Water Development

W89_02579

LAND AND WATER MANAGEMENT ISSUES: TEXAS HIGH PLAINS, For primary bibliographic entry see Field 6D. W89-02634

CLAM SHELL DREDGING IN LAKES PONT-CHARTRAIN AND MAUREPAS, LOUISIANA, Army Engineer District, New Orleans, L.A. D. L. Chew.

D. L. Chew.
Available from the National Technical Information Service, Springfield, V.A. 22161, as AD-A182 387. Price codes: A14 in paper copy, A01 in microfiche. Draft Environmental Impact Statement and Appendices, April 1987. 379p, 9 fig, 8 tab, 81 ref, 9 append. append.

Descriptors: *Dredging, *Shells, *Environmental effects, *Environmental impact statement, *Lake Pontchartrain, *Lake Maurepas, *Louisiana, Biological studies, Fish, Benthic environment, Turbidity, Water quality, Environmental effects.

Clam shells (Rangia) have been harvested from the lakes area since 1933 by means of hydraulic dredges. The shells are used primarily in construction activities, but have a variety of other uses as well. There has been considerable controversy over the environmental impacts of shell dredging. This draft Environmental Impact Statement (EIS) has been prepared to assess these impacts. It is likely that shell dredging has contributed to some extent to the apparent long-term increase in turbidity in Lake Pontchartrain. Based on review of several dredging studies, shell dredging produces a layer of fluid mud about 4-8 inches thick in the vicinity of the dredge. This layer probably reduces in thickness to about 2-4 inches within 200 m of the dredge and would continue to diminish with intion activities, but have a variety of other uses as dredge and would continue to diminish with in-creasing distance. With regard to contaminants, studies indicate that the highest levels of contami-nants occur in nearshore sediment, particularly where outfall canals and tributaries enter the lakes. Shell dredging does not have a significant direct impact on the grassbeds in Lake Pontchartrain, although the increase in turbidity in the immediate although the increase in turbidity in the immediate vicinity of operating dredges would temporarily decrease phytoplankton production. Major changes in the benthic community have taken place since the first studies were conducted in the 1950's, the most notable being the dramatic reduction in abundance of large Rangia in the open lake. Studies regarding the fishery resources of the lakes have been reviewed in the EIS, and abundance and frequency of occurrence of some demersal fish species since the 1950's, including sand seatrout, spot, hogehoker, and southern flounder. (Lantz-PTT) W89-02715

DREDGING: TECHNOLOGY AND ENVIRON-MENTAL ASPECTS, CITATIONS FROM THE LIFE SCIENCES COLLECTION DATABASE (JAN 78 - AUG 87)

National Technical Information Service, Spring-field, VA.

For primary bibliographic entry see Field 2J. W89-02783

CUMULATIVE IMPACT ASSESSMENT: AP-PLICATION OF A METHODOLOGY, Argonne National Lab., IL. Energy and Environ-For primary bibliographic entry see Field 7C. W89-02824

EFFECTS OF AERATION AND MINIMUM FLOW ENHANCEMENT ON THE BIOTA OF NORRIS TAILWATER,

Tennessee Valley Authority, Norris. Office of Natural Resources. For primary bibliographic entry see Field 5G. W89-02826

NEW HAVEN HARBOR NUMERICAL MODEL STUDY

Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab. D. R. Richards.

Available from the National Technical Information Service, Springfield, VA 22161. Technical Report HL-88-224, September 1988. Final Report. 72p, 9 fig, 42 ref.

Descriptors: *Estuaries, *Model studies, *Numerical analysis, *Connecticut, *New Haven Harbor, *Environmental effects, *Dredging, Water circulation, Oysters, Water depth, Fisheries, Tides.

Results are given from a numerical model study of Results are given from a numerical model study of the impacts of deepening and widening the approach channels and inner turning basin in New Haven Harbor, CT. Results from the study were intended to determine changes in circulation, which might affect valuable oyster resources, and to form the current fields needed to provide a detailed ship simulation study of the navigation improvement project. The US Army Corps of Engineers numerical modeling system, TABS-2, was used to predict the changes that might occur to circulation patterns in New Haven Harbor and portions of Long Island Sound. Currents were predicted in the navigation channel as well as in distant shallow regions where there is a significant distant shallow regions where there is a significant shellfish fishery. Results from the numerical model study indicated that there were perceptible changes in the circulation patterns but that the changes in the circulation patterns but that the magnitude of the changes was very small. In most cases, base-minus-plan differences in the currents were less than 0.1 fps. The largest differences occurred in the deepened channels, away from the shallow oyster bed areas. No tide differences were detected between base and plan. (Author's abstract) W89-02874

TEMPERATURE ANALYSIS, HOWARD A. HANSON RESERVOIR, WASHINGTON: MATHEMATICAL MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab. For primary bibliographic entry see Field 2H. W89-02877

HYDROLOGY AND WATER QUALITY OF A DRAINED CLAY CATCHMENT, LOCKLE PARK, NORTHUMBERLAND, Ministry of Agriculture, Fisheries and Food, Cambridge (England). Field Drainage Experimental University

For primary bibliographic entry see Field 2E. W89-02889

SOURIS RIVER BASIN PROJECT, SASKATCH-EWAN, CANADA - NORTH DAKOTA, U.S.A. GENERAL PLAN REPORT AND DRAFT ENVI-RONMENTAL IMPACT STATEMENT.

Army Engineer District, St. Paul, MN. For primary bibliographic entry see Field 8A. W89-02937

EFFECTS OF STEADY VERSUS FLUCTUATING FLOWS ON AQUATIC MACROINVERTEBRATES IN THE COLORADO RIVER BELOW GLEN CANYON DAM, ARIZONA, Arizona Game and Fish Dept., Phoenix. W. C. Leibfried, and D. W. Blinn.

Available from the National Technical Information Avanable from the National Technical Information Service, Springfield, VA 22161, as PB88-206362. Price codes: A04 in paper copy, A01 in microfiche. Final Report, June 1, 1987. 59p, 27 fig., 10 tab, 50 ref. Arizona Game and Fish Department Contract 6400042 Extension.

Descriptors: *Colorado River, *Ecological effects, *Water resources development, *Reservoir releases, *Macroinvertebrates, Stream flow, *Glen Canyon Dam, Arizona, Biomass, Little Colorado

The impacts of fluctuating versus steady discharges from Glen Canyon Dam on aquatic macroinvertebrate drift, distribution and standing crop in the Colorado River were studied during 1985 and 1986. A significant positive correlation

exists between Gammarus drift and increasing flows. Mean drift rates and densities of Gammarus lacustris, increased during months of fluctuating discharges. Increased drift only occurred during the rising arm of discharge after periods of low flows below 5,000 cu ft/sec. The most abundant invertebrates in the Colorado River were chironomids, amphipods and oligochaetes. Total standing crop of macrobenthos declined significantly at sites below the confluence of the Little Colorado River. Below the confluence of the Little Colorado River, chironomids dominated the main river sites while Gammarus density declined. At the mouths of tributaries and within approximately 200 m below tributaries intonomids dominated with Ephemeroptera occurring in large numbers. Total benthic standing crop in the Colorado River decreased significantly under fluctuating discharges. On two occasions benthic samples were collected simultaneously in the zone of fluctuation soon after rewetting and in a non-exposed area. Macroinvertebrate density and biomass of Cladophora glomerata was reduced dramatically in substrates exposed to fluctuations. A significant positive correlation between standing crop of Gammarus lacustris and exists between Gammarus drift and increasing to fluctuations. A significant positive correlation between standing crop of Gammarus lacustris and Cladophora glomerata biomass was observed for Claudphora giomerata obtains was observed to July and October 1985. Pooled data for all four months showed a significant positive correlation between Gammarus abundance and Cladophora biomass. (Author's abstract) W89_02940

CUMULATIVE IMPACT ASSESSMENT: ISSUES TO CONSIDER IN SELECTING A CUMULATIVE ASSESSMENT METHOD,

Argonne National Lab., IL. Energy and Environ-mental Systems Div. For primary bibliographic entry see Field 5C. W89-02965

RIVERINE ECOSYSTEMS, Cape Town Univ. (South Africa). Dept. of Zoology. For primary bibliographic entry see Field 2H.

USES OF, AND HUMAN IMPACT ON RIVERS, Natal Univ., Pietermaritzburg (South Africa). Dept. of Zoology. For primary bibliographic entry see Field 4C.

LAND SUBSIDENCE IN THE SAN JOAQUIN VALLEY, CALIFORNIA, AS OF 1980,

R. L. Ireland, J. F. Poland, and F. S. Rilev R. L. Ireiand, J. F. Poland, and F. S. Ruje Available from Books and Open-File Reports Sec-tion, USGS, Box 25425, Denver, CO 80225. USGS Professional Paper 437-I, 1984. 193p, 67 fig, 6 tab, 55 ref, (Studies of Land Subsidence).

Descriptors: *California, *San Joaquin Valley, *Groundwater withdrawal, *Subsidence, *Surfacegroundwater relations, Extensometers, California Aqueduct, Interbasin transfers, Leveling.

The three major areas of land subsidence due to groundwater withdrawal in the San Joaquin Valley are the Los Banos-Kettleman City area, the Tulare-Wasco area, and the Arvin-Maricopa area. The latest areawide leveling was in 1972 in the Los Banos-Kettleman City area and in 1969-1970 in the Tulare-Wasco and Arvin-Maricopa areas. The 1972 Los Banos-Kettleman City area leveling showed that subsidence rates had decreased sharply with the importation of surface water through ly with the importation of surface water through the California Aqueduct in the late 1960's and early 1970's. The California Aqueduct leveling showed a continued decrease in the rate of subsidshowed a continued decrease in the rate of subsidence along the aqueduct through 1975, followed by increased subsidence during the drought years of 1976-1977. Leveling by the Los Angeles Department of Water and Power in the Tulare-Wasco area showed that east and west of Delano, subsidence continued into 1974. In the late 1960's and early 1970's, water levels in wells recovered to levels of the 1940's and 1950's in response to decreased groundwater withdrawals. Data collected

Ecologic Impact Of Water Development—Group 6G

at water-level and extensometer sites during the 1976-1977 drought showed the effect of the heavy demand on the groundwater reservoir. With the water of compaction gone, artesian head declined 10 to 20 times as fast as during the first cycle of long-term drawdown that ended in the late 1960's. Extensometers measured compaction ranging from 0.1 to 0.5 ft in 1977. In 1978-1979 water levels recovered to or above the 1976 predrought levels. Extensometer response ranged from compaction of a few hundredths of a foot to expansion of nearly 0.20 ft. Continued monitoring of land subsidence in the San Joaquin Valley is recommended. (Author's abstract) abstract) W89-03018

LAND SUBSIDENCE IN THE SANTA CLARA VALLEY, CALIFORNIA, AS OF 1982, J. F. Poland, and R. L. Ireland.

J. F. Poland, and K. L. Ireland.
Available from Books and Open-File Reports Section, USGS, Box 25425, Denver, CO 80225. USGS Professional Paper 497-F, 1988. 61p, 48 fig, 6 tab, 38 ref, (Mechanics of Aquifer Systems).

Descriptors: *Santa Clara Valley, *Groundwater withdrawal, *Subsidence, *California, *Surfacegroundwater relations, Extensometers, Flooding, San Francisco Bay, Artesian head, Aquifer management, Estuaries, Flood damage, Crustal rebound.

From 1916 to 1966 in the San Jose area of the Santa Clara Valley, California, generally deficient rainfall and runoff was accompanied by a fourfold increase in withdrawals of groundwater. In response, the artesian head declined 180 to 220 ft. As a direct result of the artesian head decline, the land surface subsided as much as 12.7 ft in San Jose, due to the compaction of the fine-grained compressible confining beds and interbeds as their pore pressures decreased. The subsidence resulted in flooding of lands bordering the southern part of San Francisco Bay, and the compaction of the sediments caused compressional failure of well casings in several hundred water wells. The gross costs of subsidence to date are estimated to be \$30 to \$40 million. The recovery of artesian head since 1967 has been substantial. In downtown San Jose, the artesian head recovered 70 to 100 ft in the 8 years to 1975. Recovery of water levels was due to a fivefold increase in surface water imports from 1965 to 1975, favorable local water supply, decreased withdrawal, and increased recharge. In 1960, the U.S. Geological Survey installed extensometers in coreholes 1,000 ft deep in San Jose and Sunnyvale. Measurements obtained from these extensometers demonstrate the marked decrease in annual compaction of the confined aquifer system in response to the major head recovery since 1967. In San Jose, for example, the annual compaction decreased from about 1 ft in 1961 to 0.24 ft in 1967 and to 0.01 ft in 1973. Net expansion (land-surface rebound) of 0.02 ft occurred in 1974. (Author's abstract) abstract) W89-03019

EFFECTS OF FUTURE GROUND-WATER PUMPAGE ON THE HIGH PLAINS AQUIFER IN PARTS OF COLORADO, KANSAS, NEBRASKA, NEW MEXICO, OKLAHOMA, SOUTH DAKOTA, TEXAS, AND WYOMING, Geological Survey, Arvada, CO. For primary bibliographic entry see Field 2F. W89-03031

EFFECTS OF HYDROELECTRIC SCHEME ON FLUVIAL ECOSYSTEMS WITHIN THE SPANISH PYRENEES, Universidad Politecnica de Madrid (Spain). Escuela Tecnica Superior de Ingenieros de Montes. D. Garcia de Jalon, C. Montes, E. Barcelo, C. Casado, and F. Menes. Regulated Rivers Research and Management RRMEP, Vol. 2, No.4, p. 479-491, September-October 1988. 3 fig, 6 tab, 36 ref.

Descriptors: *Environmental impact, *Dam effects, *Spain, *Hydroelectric power, *Aquatic ecosystems, Benthos, Flow pattern, Water temperature, Regulated rivers, River Cinca, Fisheries, Trout, Flow regulation.

The effects on faunal communities of a high head, low capacity hydroelectric power project are evaluated for the River Cinca, a Pyrenean tributary of the River Ebro (North East of Spain). The macrobenthic fauna of the regulated Cinca River is compared with the unregulated Ara River. Colder summer water temperatures in the Cinca River are shown to have caused a reduction in species richness of the macrobenthic community as a consequence of the elimination of thermophilous species. Reduced temperatures may also explain the lower growth rate and productivity of the trout populations. Sudden flow fluctuations caused by hydropower generation influence the downstream macrobenthic communities; their populations are less abundant (reduction in densities and biomass) and their structure is less diverse. Although trout fishabundant (reduction in densities and biomass) and their structure is less diverse. Although trout fish-eries do not seem to be directly affected by sudder flow fluctuations, the limitation of their food re-sources (benthos), has reduced trout production and turnover ratio. (Author's abstract) W89-03138

FISH POPULATIONS OF A SMALL LOW-LAND CHANNELIZED RIVER IN ENGLAND SUBJECT TO LONG-TERM RIVER MAINTE-NANCE AND MANAGEMENT WORKS,

Liverpool Univ. (England). Dept. of Zoology. S. Swales.

Regulated Rivers Research and Management RRMEP, Vol. 2, No. 4, p 493-506, September-October 1988. 6 fig, 5 tab, 35 ref.

Descriptors: *Environmental impact, *Stream improvement, *Rivers, *Fish populations, *Water management, *Channeling, England, Species di-

Fish populations in the Perry River, a small low-land channelized river in England, were affected by long-term river maintenance and improvement works. Habitat diversity at two 'old channelized' sites was low compared with a downstream 'par-tially channelized' site and an unmodified site, where natural river features such as the pool-riffle pattern were more amoret. The fish compounds where natural river features such as the pool-riffle pattern were more apparent. The fish community was low in diversity at all sites, with two running-water cyprinids, dace Leuciscus leuciscus (L.) and Leuciscus cephalus (L.), being the dominant fish species. Relative species composition varied between sites, with dace predominating at the 'old channelized' sites and chub increasingly dominant at the 'partially channelized' and unmodified sites. Population density and biomass estimates of dace were similar at all sites, but chub were up three times more abundant at the 'partially channelized' and unmodified sites than at the 'old channelized' sites. Populations of dace and chub at the 'old channelized' sites contained a higher proportion of sites. Populations of dace and chub at the 'old channelized' sites contained a higher proportion of small fish than populations at the downstream sites, which exhibited a more balanced population structure. The growth rates of both dace and chub varied between sites. Low recaptures of marked dace suggested a highly mobile movement pattern while higher recapture rates of chub, particularly at the 'partially channelized' and unmodified sites, seemed to indicate a more sedentary activity pattern. Long-term river maintenance and management works may delay the morphological and biological recovery of lowland channelized rivers. (Author's abstract)
W89-03139

ROLE OF RIPARIAN WOODS IN REGULAT-ING NITROGEN FLUXES BETWEEN THE AL-LUVIAL AQUIFER AND SURFACE WATER: A CONCEPTUAL MODEL, Centre National de la Recherche Scientifique, Toulouse (France). Centre d'Ecologie des Res-sources Renouvelables.

G. Pinay, and H. Decamps. Regulated Rivers Research and Management RRMEP, Vol. 2, No. 4, p 507-516, September-October 1988. 3 fig. 1 tab, 74 ref.

Descriptors: *Environmental impact, *Dam effects, *Fate of pollutant, *Alluvial aquifers, *Riparian land, *Wetlands, *Models, *Nitrogen, Water management, Rivers, Soil chemistry, Seasonal variation, Denitrification, Forests.

Conceptual models are proposed to explain nitrogen fluxes in the soils of riparian zones in relation to the different modalities of water logging and nitrate inputs. Non-submerged, temporarily submerged and always submerged sites are considered in both winter and summer. Capacities for epuration are elevated for nitrate loads from the alluvial aquifer during the lateral transfer of water from agricultural land to the river through the riparian zone. About 30 m of groundwater flow under the riparian wood studied is sufficient to remove all nitrate. Denitrification rates up to 50 mg N2/sq m/day were observed in the field, but a potential for more denitrification exists. The efficiency of the riparian woods an attural filter regulating nutrient transfers to the river deserves more consideration in river management. (Author's abstract) W89-03140

RADIAL STEM GROWTH OF CONIFEROUS TREES NEAR SWEDISH RESERVOIRS, Umea Univ. (Sweden). Dept. of Ecological Botany. G. Grelsson

Regulated Rivers Research and Management RRMEP, Vol. 2, No. 4, p 535-545, September-October 1988. 6 fig, 3 tab, 31 ref.

Descriptors: *Environmental impact, *Dendroch-ronology, *Reservoirs, *Dam effects, *Water level fluctuations, Plant growth, Water management, Sweden, Day

Tree ring data are presented for two species of coniferous trees growing close to the margins of two contrasting types of reservoir, and annually regulated one (bordered by Picea abies) and a daily and weekly regulated one (Pinus sylvestris). The radial growth-ring data for the periods before and radial growth-ring data for the periods before and after damming and regulation were compared uti-lizing a mathematical growth model. The basic hypothesis was that changed water-level condi-tions due to hydroelectric development would change the groundwater levels and associated fac-tors and thus affect tree growth. For spruce trees growing along the long-term (annually) regulated reservoir, no significant differences in growth be-tween the pre-damming and post-damming periods were found; nor was any correlation found between the pre-damming and post-damming periods were found; nor was any correlation found between tree growth and the duration of the period of high-water level in this reservoir. For pine trees growing along the short-term (daily and weekly) regulated reservoir a significant increase in the variation in growth was found following regulation, but only at the lowest levels. No other significant differences in tree growth between the peri-ods before and after regulation were found. (Author's abstract)

EFFECT OF IMPOUNDMENT ON THE GROWTH OF BAGRUS DOCMAC IN LAKE NASSER

Menoufia Univ., Shibin al-Kom (Egypt). Dept. of Zoology. E. A. Khallaf.

Regulated Rivers Research and Management RRMEP, Vol. 2, No. 4, p 547-552, September-October 1988. 1 fig, 4 tab, 13 ref.

Descriptors: *Environmental Impact, *Fish populations, *Reservoirs, *Catfish, *Dam effects, Lakes, Egypt, Model studies, Reservoir fisheries, Lake Nasser, Growth.

Changes of faunistic composition in impounded reaches of regulated rivers have been related to changes in environment from lotic to lentic. Rarely has this assumption been tested, however. Bagrus docmac is a long-lived freshwater catfish and was once a commercially valuable species in Lake Nasser. Its production declined abruptly following the early years of impoundment of the lake. This decline is significantly correlated to the increase of Tilapia catch. A modified model for the surplus production is introduced and estimated the potential yield as 195.7 metric tons. Relative growth rate of weight over length interval showed that the fish ranging between 20 to 40 cm in standard length

Field 6-WATER RESOURCES PLANNING

Group 6G-Ecologic Impact Of Water Development

have had the highest rate of weight gain which is have had the highest rate of weight gain which is attributed to gear selective mortality. Fish (18-83 cm in standard length) vertebrae (N=105) are used for growth analysis, after their annuli are validationally an ed. Age-groups ranged between I to VI with an average age of 3.14. Age-groups II suffered high selective mortality which caused a fishing-up effect that took about four years to appear in the catch. Thus, the problem of Bagrus may be safely attributed to the effect of fishing gears which are mainly used to catch the relatively smaller Tilapia. (Author's abstract) thor's abstract) W89-03143

ENVIRONMENTAL MANAGEMENT OF THE ZAMBEZI RIVER SYSTEM, Ministry of Agriculture and Water Development, Lusaka (Zambia). For primary bibliographic entry see Field 5G. W89-03148

ATTEMPT TO FACILITATE WATER MANAGEMENT ISSUES IN THE ZAMBEZI RIVER BASIN USING DECISION SUPPORT SYS-

international Inst. for Applied Systems Analysis, Laxenburg (Austria).

For primary bibliographic entry see Field 5G.

W89-03145

7. RESOURCES DATA

7A. Network Design

NEW APPROACHES TO MONITORING AQUATIC ECOSYSTEMS. For primary bibliographic entry see Field 5A. W89-02317

MONITORING THE NATION'S WATERS-A NEW PERSPECTIVE, Environmental Protection Agency, Washington, DC. Office of Toxic Substances. For primary bibliographic entry see Field 5A. W89-02318

STRATEGIES FOR LONG-TERM POLLUTION MONITORING OF THE COASTAL OCEANS, California Univ., Richmond. Sanitary Engineering and Environmental Health Research Lab. For primary bibliographic entry see Field 5A. W89-02319

INNOVATIVE DESIGNS FOR WATER QUAL-ITY MONITORING: ARE WE ASKING THE QUESTIONS BEFORE THE DATA ARE COL-LECTED, Minnesota Univ., St. Paul. Dept. of Forest Re-

sources.
J. A. Perry, D. J. Schaeffer, and E. E. Herricks.
IN: New Approaches to Monitoring Aquatic Ecosystems. American Society for Testing and Materials, Philadelphia, PA. 1987. p. 28-39, 1 fig. 23 ref.

Descriptors: *Water quality, *Water quality management, *Monitoring, *Network design, *Sampling, *Environmental audit, Decision making,

Water quality management consists of decisions about the environment; those decisions are usually based on data from monitoring programs. Such data are usually collected following a design that is governed by 'bureaucratic risk,' that is, the perceived risk of ire from a superior. The application of a systematic process called the Environmental Audit is proposed as a tool for guiding management decision making and for design of monitoring programs. Application of the Audit is shown to produce data which leads directly to real environmental information (in contrast to pure data). Such mental information (in contrast to pure data). Such information is translated into management deci-sions which incorporate all elements of the broader definitions of environmental risk. (See also W89-02317) (Author's abstract)

MULTIDECADE TREND-MONITORING PRO-GRAM FOR CHESAPEAKE BAY, A TEMPER-ATE EAST COAST ESTUARY.

ATE EAST COAST ESTUARY, Environmental Protection Agency, Annapolis, MD. Chesapeake Bay Program. K. Mountford, and G. Mackiernan. IN: New Approaches to Monitoring Aquatic Ecosystems. American Society for Testing and Materials, Philadelphia, PA. 1987. p 91-106, fig, 2 tab, 19

Descriptors: *Monitoring, *Water quality, *Data collection, *Ecosystems, *Estuaries, *Chesapeake Bay, *Eutrophication, Chlorophyll, Government supports, Nutrients, Toxins, Phytoplankton, Zooplankton, Spatial distribution, Temporal distribution,

In the past two decades, Chesapeake Bay has experienced apparent increasing periods of deep water anoxia, poor spawning success by anadromous fish species, and unprecedented declines in submerged aquatic vegetation. These changes coincide with increased loading of nutrients and toxic materials increased loading of nutrients and toxic materials from the surrounding 109,219 ay km drainage basin, which is experiencing significant changes in land use and population density. Concern by basin governments and citizens led ultimately to the establishment in 1984 of a 167-station monitoring network reporting to a common data bank. This program is designed to operate for at least 1.5 to 2 decades and to define trends in Bay water and sediment quality during that period. Twenty water and sediment quality argameters are monitored 20 sediment quality during that period. Twenty water and sediment quality parameters are monitored 20 times per year in the main stem and principal tidal tributaries. Collections link with studies of sediment organics, toxics, benthos, phyto- and zoo-plankton, and commercially harvested species. Data for 1984 indicate that large riverine inflows produced intense water column stratification and unusually widespread anoxia in the Bay main stem, but mixing events and wind forcing may temporarily reduce severity and promote reaeration. Early data sets indicate pulses of nutrient input into the estuary. Intrient resentation in subpoycnoclinal unta sets indicate pulses of nutrient input into the estuary, nutrient regeneration in subpycnoclinal water, phtyoplankton response to nutrients, as well as instances of potential nutrient limitation. (See also W89-02317) (Author's abstract) W89-02324

COASTAL MONITORING: EVALUATION OF MONITORING METHODS IN NARRAGAN-SETE BAY, LONG ISLAND SOUND AND NEW YORK BIGHT, AND A GENERAL MONITOR-ING STRATEGY, Environmental Protection Agency, Narragansett, R.I. Environmental Research Lab. For primary bibliographic entry see Field 5A. W89-02325

'MUSSEL WATCH'-MEASUREMENTS OF CHEMICAL POLLUTANTS IN BIVALVES AS ONE INDICATOR OF COASTAL ENVIRON-MENTAL QUALITY,

Woods Hole Oceanographic Institution, MA. Coastal Research Center. For primary bibliographic entry see Field 5A. W89-02326

MONITORING AND QUALITY ASSURANCE PROCEDURES FOR THE STUDY OF REMOTE WATERSHED ECOSYSTEMS, Michigan Technological Univ., Houghton. Dept. of Biological Sciences. For primary bibliographic entry see Field 5A. W89-02330

ASSESSMENT OF THE ADEQUACY OF THE GROUND-WATER MONITORING SYSTEM FOR ARTHFICIAL RECHARGE OF AQUIFERS IN THE LOS ANGELES AREA, CALIFORNIA, Western Water Consultants, Inc., Laramie, WY. M. Nikkel, T. Mueller, K. Thompson, and P. Rechard.

IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National

Water Well Association, Dublin, OH. 1988. p 45-69, 7 fig, 6 tab, 9 ref.

Descriptors: *California, *Network design, *Monitoring, *Artificial recharge, *Groundwater monitoring, *Groundwater monitoring, *Groundwater management, *Water pollution sources, Pollutant identification, Hydrology, Geo

Artificial recharge of aquifers in the Central and West Coast groundwater basins of Southern Cali-fornia is accomplished by the application of waters, including reclaimed water, to spreading grounds within the basins. All of the sources of water applied to the basins are known to contain water applied to the basins are known to contain low levels of drinking water contaminants. In addition, the basins receive groundwater as underflow from the San Gabriel Basin. The entire San Gabriel Basin has been designated an Environmental Protection Agency National Priorities List (NPL) site. A groundwater monitoring program has been established to assure that the use of replenishment. water has not had and will not have adverse effects on the quality of groundwater in the basins. At the request of the Central and West Basin Replenish-ment District, Western Water Consultants, Inc. inequest of the Central and west hasin Replenishment District, Western Water Consultants, Inc. conducted an assessment of the monitoring program that was in practice. During this assessment, significant weaknesses were identified concerning the ability of the Replenishment District to detect contamination of groundwater caused by the artificial recharge basins. Recommendations for improvement of the monitoring program include: (1) more extensive sampling of ground and surface water entering from adjacent areas; (2) installation of additional shallow wells to monitor the quality of water entering the aquifers at the replenishment spreading grounds; (3) establishment of written protocol, standard operating procedures and an employee training program for sampling; (4) more intensive monitoring of urban storm water and reclaimed water for possible adverse effects on groundwater, and (5) consideration of known point sources of groundwater contamination in the interpretation of sampling results. (See also W89-02331) (Author's abstract) (Author's abstract) W89-02335

STATEWIDE GROUNDWATER QUALITY MONITORING NETWORK DESIGN,

Arizona Dept. of Environmental Quality, Phoenix. For primary bibliographic entry see Field 5A. W89-02343

DATA REQUIREMENTS FOR HYDROGEOLO. GICAL MAPS,

Bundesanstalt fuer Geowissenschaften und Roh-stoffe, Hanover (Germany, F.R.). K. D. W. Krampe

In: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p. 263-292, 13 fig, 9 ref.

Descriptors: *Groundwater, *Standards, *Maps, *Hydrogeology, Data interpretation.

The content of groundwater maps has been reviewed with special regard to the importance of hydrogeological parameters. The data have been classified as essential, very important, and desirable data. The significance of all relevant data and parameters has been described at some length. Three types of groundwater maps have been distinguished: single- parameter maps, comprehensive hydrogeological maps, and groundwater potential maps. In addition to field inventories, data acquisition from lithological logs and hydrochemical analyses has been explained. A series of 13 figures has been inserted. Finally, recommendations have been made for the preparation of maps with reference to the hydrogeologist's role. Remarks on data plotting and how to augment the amount of data have been included. (See also W89-02364) (Author's abstract) W89-02387

HYDROGEOLOGICAL MAPS FROM THE VIEW-POINT OF THE USER,

RESOURCES DATA—Field 7

Network Design-Group 7A

International Association of Hydrogeologists, Paris (France). E. Romiin

E. Komjii.

IN: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p 325-330, 1 fig.

Descriptors: *Hydrogeology, *Maps, *Data collection, Land use, Water resources development, Automation, Data storage and retrieval, Data ac-

Hydrogeological maps directed to practical use by engineers or planners in preparing decisions of practical importance are discussed. Applied hydrogeology aims at evaluating groundwater resources, suitability for effective land use and prediction and prevention of possible wrong use of the landsurface or the groundwater. Different kinds of human influences are directly related to different forms of prevention of possible wrong use of the landsurface or the groundwater. Different kinds of human influences are directly related to different forms of land use. Some examples of such relatins follow: (a) housing level control (in low areas) abstraction for drinking water, or pollution hazard by sewerage systems; (b) industry abstraction for process and cooling water; (c) agriculture — drainage or irrigation systems, and pollution hazard by fertilizers or pesticides; (d) use of mineral-thermal springs for recreation or medical treatment, (e) soil mechanical properties in relatin to groundwater level and pollution hazard of traffic and pipelines; (f) pumping of water excess and pollution hazard of mining an excavations; (g) energy production use of thermal water or (with heat pumps) normal groundwater; and (h) waste disposal use of purification properties of the soil and waste disposal pollution hazard. Small scale maps (1:500 000 tol.) 5 000 000) will often give more-or-less integrated pollution hazard. Small scale maps (1: 300 000 to 1: 5 000 000) will often give more-or-less integrated information, but single-value maps on this scale are not readable. Intermediate scale maps (1: 100 000 to 1: 500 000) may be excellent tools for regional (town and country) planning and water management planning. Large scale maps (larger than 1: 100 000) are real tools for data collection, local 100 000) are real tools for data collection, local research programs, mathematical modelling of hydrogeological system, planning of technical systems (trigation, waterworks, etc.) and city planning. In many cases perhaps still futuristic, hydrogeological data bases will sooner or later be established all over the world and will serve mankind not only for their basic needs of water, food and housing but also for industrial development and recreational purposes in the broadest sense. (See also W89-02364) (Davis-PTT)

DESIGN OF A GREAT LAKES ATMOSPHEDIC INPUTS AND SOURCES (GLAIS) NETWORK, De Paul Univ., Chicago, IL.

De Paul Univ., Chicago, IL.

T. J. Murphy.

Available from the National Technical Information
Service, Springfield, VA. 22161, as PB87-213534.

Price codes: A03 in paper copy, A01 in microfiche.
EPA Report No. EPA-905/4-87-001, March 1987.
GLNPO No. 87-03. 35 p, 8 fig, 49 ref, 2 append.
EPA Grant R005818-01.

Descriptors: *Network design, *Sampling, *Great Lakes, *Air pollution, *Water pollution sources, Path of pollutants, Costs, Research needs, Clima-tology, Aerodynamics, Chemistry, Meteorology, Hydrodynamics, Interdisciplinary studies.

A spellout (GLAIS) data network will of necessity, be complex and expensive. Because of these factors, the objectives must be well thought out in advance, be realistic and be firmly based on good science and available technology. There are at least five distinct mechanisms for inputs of materials from the atmosphere to bodies of water. They are: rain, snow, small particles (< 2 micrometers), large particles (< 2 micrometers), large particles (> 2 micrometers), and vapor exchange. In general, very different methods and techniques are necessary to determine the inputs by each of these mechanisms. Because of the expense in setting-up and operating (including analyses) a monitoring site for a variety of parameters involved with different mechanisms and/or also obtaining information on sources, a GLAIS network may consist of a relatively few sites. Because of the uncertainties in the capability to determine inputs occurring by any of the five above mechanisms, will need a research component. To be A spellout (GLAIS) data network will of necessi-

successful, expertise in a number of disciplines will be needed to develop a good network plan. These disciplines include: aerodynamics, chemistry, climatology, cloud physics, geochemistry, hydrodynamics, meteorology, and micrometeorology. (Lantz-PTT) W89-02418

BED LOAD SAMPLING AND ANALYSIS, Geological Survey, Lakewood, CO. For primary bibliographic entry see Field 2J. W89-0243.

DIRECTORY OF PRECIPITATION MONITOR-ING SITES, NATIONAL ATMOSPHERIC DEP-OSITION PROGRAM/NATIONAL TRENDS NETWORK (NADP/NITN).

NETWORK (NADP/NITN).
National Acid Precipitation Assessment Program, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161, as PB88-218284/AS. Price code: A99 in paper copy. Report of Interagency Task Force on Acid Precipitation, November 1986, 972p, Vol 2. Funded by U.S. Geological Survey as lead agency for Task Group IV, Atmospheric deposition and Air Quality Monitoring, Edited by John K. Robertson and Dorethea Wojciechowski, US Mili

Descriptors: *Atmospheric precipitation networks, *Data collections, *Maps, *Directories, *Research facilities, *Acid rain, Wet deposition monitoring, Precipitation chemistry, Acid rain monitoring sites, Monitoring sites, Monitoring site protocols.

The Directory of Precipitation Monitoring Sites contains a four page description of each of the atmospheric precipitation monitoring sites that has operated or was operating as part of the National Atmospheric Deposition Program/National Trends Network (NADP/NTN) on July 1, 1986. Each site discription contains information, including photographs and maps, that locates the site; identifies operating and sponsoring organizations; characterizes surroundings, including point sources of emissions within 50 km; identifies equipment at the site, describes other monitoring activities and watershed research at the site; and lists significant events in the history of the site. The Site Directory is presented in two volumes for ease of use. Volume 1 contains introductory material, location maps, and sites with State abbreviations in the range from A - M. Volume 2 contains sites whose State abbreviations are in the range N - Z. (Frisch-WRD) WRD) W89-02480

METHODS FOR HYDROLOGIC MONITOR-ING OF SURFACE MINING IN THE CEN-TRAL-WESTERN UNITED STATES,

Geological Survey, Denver, CO. Water Resources

Div. J. T. Turk, R. S. Parker, and R. S. Williams. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 84-600, 1986. 96p, 17 fig, 8 tab, 71 ref.

Descriptors: *Monitoring, *Coal mines, *Ground-water quality, *Water quality, *Networks, Surface waters, Meteorology, Hydrologic data.

The regulations promulgated pursuant to the Surface Mining Control and Reclamation Act require the monitoring of potentially impacted hydrologic systems before, during, and after mining operations. This report details characteristics and procations. Inis report details characteristics and proc-esses that commonly determine the most accepta-ble approaches to hydrologic monitoring in the arid and semiarid central-western United States. No single approach is best for all hydrologic sys-tems; consideration of basin characteristics, regulatems; consideration of basin characteristics, regulatory requirements, and regional patterns in hydrologic systems is necessary in any well-designed monitoring program for hydrologic-impact assessment. This report describes processes and characteristics that control the surface and subsurface hydraulics, as well as the water quality, of typical hydrological systems being mined in the central hydrological systems being mined in the central western United States. After a discussion of these processes and characteristics, three examples are

presented that describe acceptable, but nonexclusive, approaches to hydrologic monitoring network design. (USGS) W89-02490

DESCRIPTION OF PIEZOMETER NESTS AND WATER LEVELS IN THE RIO GRANDE VALLEY NEAR ALBUQUERQUE, BERNALIILLO COUNTY, NEW MEXICO, Geological Survey, Albuquerque, NM. Water Resources Div.

For primary bibliographic entry see Field 2F. W89-02509

WATER QUALITY OF RUNOFF TO THE CLARKSVILLE MEMORIAL HOSPITAL DRAINAGE WELL AND OF MOBLEY SPRING, CLARKSVILLE, TENNESSEE, FEBRUARY-MARCH 1988, Geological Survey, Nashville, TN. Water Resources Div.

For primary bibliographic entry see Field 5B. W89-02556

SURFACE WATER HYDROLOGY, Vizgazdalkodasi Tudomanyos Kutato Intezet, Bu-dapest (Hungary). For primary bibliographic entry see Field 2E.

SNOW AND ICE, Manchester Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2C. W89-02722

BIOLOGICAL SURVEYS OF ESTUARIES AND COASTS. For primary bibliographic entry see Field 7B. W89-02759

PLANNING BIOLOGICAL SURVEYS. Field Studies Council, Shrewsbury (England). For primary bibliographic entry see Field 7B. W89-02760

REMOTE SENSING, Imperial Coll. of Science and Technology, London (England). Dept. of Pure and Applied Biology. For primary bibliographic entry see Field 7B. W89-02761

SALT MARSHES, Imperial Coll. of Science and Technology, London (England). Dept. of Pure and Applied Biology. For primary bibliographic entry see Field 7B. W89-02762

FLORA AND MACROFAUNA OF INTERTI-DAL SEDIMENTS, Rijksinstituut voor Natuurbeheer, Texel (Nether-lands).

For primary bibliographic entry see Field 2L. W89-02763

MACROFAUNA OF SUBTIDAL SEDIMENTS USING REMOTE SAMPLING, BP Petroleum Development Ltd., Aberdeen (Scot-For primary bibliographic entry see Field 2L. W89-02764

PROCESSING SEDIMENT MACROFAUNA SAMPLES, BP Petroleum Development Ltd., Aberdeen (Scotland). For primary bibliographic entry see Field 7B. W89-02765

MEIOFAUNA, Institute for Soil Fertility, Haren (Netherlands).

Field 7-RESOURCES DATA

Group 7A-Network Design

For primary bibliographic entry see Field 2L.

INTERTIDAL ROCK, Field Studies Council, Shrewsbury (England). For primary bibliographic entry see Field 2L.

SUBTIDAL ROCK AND SHALLOW SEDI-MENTS USING DIVING, Field Studies Council, Pembroke (Wales). Oil Pol-lution Research Unit. For primary bibliographic entry see Field 7B. W89-02768

BACTERIA AND FUNGI,

University Coll. of North Wales, Menai Bridge. School of Ocean Sciences. For primary bibliographic entry see Field 7B. W89-02769

PLANKTON.

University Coll. of North Wales, Menai Bridge. School of Ocean Sciences. For primary bibliographic entry see Field 2L. W89-02770

FISH (SURVEY OF),

Marine Biological Association of the United Kingdom, Plymouth (England). For primary bibliographic entry see Field 7B. W89-02771

Royal Society for the Protection of Birds, Shore-ham-by-Sea (England). For primary bibliographic entry see Field 2L. W89-02772

NATIONAL SURFACE WATER SURVEY: NA-TIONAL STREAM SURVEY PHASE I - PILOT

Utah Water Research Lab., Logan. For primary bibliographic entry see Field 5G. W80.02842

DESIGN OF THE PRIMARY PRE-TRMM AND TRMM GROUND TRUTH SITE,

Virginia Univ., Charlottesville. Dept. of Environtal Science

M. Garstang.

Available from the National Technical Information Service, Springfield, VA 22161, as N88-19865. Price codes: A04 in paper copy, A01 in microfiche. Annual Report, April 1, 1988. 20p, 7 fig, 1 tab, 7 ref. NASA Grant NAG-5-870.

Descriptors: *Network design, *Rainfall, *Rainfall intensity, *Data interpretation, *Data acquisition, Rainfall distribution, Precipitation, Remote sens-

Work began on the design of the primary ground truth sites on and near Cape Canaveral Florida on February 15, 1987 for (a) integrate rain gage measurements with radar measurements of rainfall using the Kennedy Space Flight Center (KSFC) Patrick digitized radar and associated rainfall network; (b) digitized radar and associated rainfall network; (b) delineate the major rain bearing systems over Florida using the Weather Service reported radar/rainfall distributions; (c) combine (a) integration of rain gage and radar measurements and (b) delineation of the Weather Service reported distribution; (d) use (c) the combination just described, to represent patterns of rainfall which actually exist AND contribute significantly to the rainfall to test sam-pling strategies. Based on the results of these analypaning stategies. Date of the leasts of miese analyses decide upon the ground truth network; and (e) complete the design begun in Phase I of a multi-scale (space and time) surface observing precipitation network centered upon KSFC. (Lantz-PTT) W89-02971

ANALYSIS OF BIOMONITORING TECHNIQUES TO SUPPLEMENT EFFLUENT GUIDELINES.

Energetics, Inc., Columbia, MD. For primary bibliographic entry see Field 5A. W89-02994

MODEL CALIBRATION BASED ON RANDOM ENVIRONMENTAL FLUCTUATIONS, Princeton Univ., NJ. Dept. of Civil Engineering and Operations Research. P. R. Jaffe, C. Paniconi, and E. F. Wood. Journal of Environmental Engineering (ASCE) JOEDDU, Vol. 114, No. 5, p 1136-1145, October 1988. 1 fig, 4 tab, 13 ref.

Descriptors: *Model studies, *Limnology, *Envi-ronmental studies, *Simulation, Monte Carlo method, Statistical analysis, Model input param-

A simple model-calibration technique that takes into account the random fluctuations of field measurements and yields probability distribution of the urements and yields probability distribution of the model input parameters. A large number of model simulations is conducted using a wide range of model input parameter values. The specific values of each input parameter in a given simulation are randomly selected from specified probability distributions. Only a subset of all simulations will yield observations. The input parameters used in this subset of simulations can then be analyzed and ooservations. The input parameters used in this subset of simulations can then be analyzed and their mean and variance are computed. This calibration procedure is a useful tool to determine the mean values of model input parameters that dominate the variance of the model's output. If the nate the variance of the model's output. If the variance of the model's output is completely dominated by a single, uncorrelated parameter, the mean and variance of this parameter can be estimated correctly. If several parameters dominate the variance of the model's output or if those parameters are correlated, correct means can still be estimated but the variances obtained for these parameters are larger than their correct values. (Author's abstract) 89-03105

REFRACTION TESTS ABOVE

WATER TABLE,
Institut de Mecanique de Grenoble, Saint-Martin

d'Heres (France).
G. Bonnet, and M. Meyer.
Journal of Geotechnical Engineering (ASCE)
JGENDZ, Vol. 114, No. 10, p 1183-1189, October
1988. 4 fig, 1 tab, 7 ref.

Descriptors: *Soil saturation, *Mathematical models, *Water table, *Geophysics, *Seismology, *Groundwater exploration, Aeration zone, Seismic refraction tests, Wave propagation.

Wave propagation in saturated soils is often de-scribed by using a two-phase or 'porcelastic' model. It is difficult to use such a model, however, because below the level of the water table there may be an unsaturated zone whose extent and characteristics are not well-known. A small amount of air has drastic consequences on the compressive-wave velocity: 0.10% of air reduces the compressive-wave velocity in the water to about one-fourth of the value when saturated. This has already been thoroughly demonstrated by laboratory experiments. However, in situ evidence of the effect of this unsaturated zone on wave propagation is not yet known, and, therefore, was carried out in this study. The results show that the interpretation of the seismic refraction tests above a water table give a depth of seismic marker that is significantly different from the actual water table depth. Two different explanations are possible at may be an unsaturated zone whose extent and significantly different from the actual water table depth. Two different explanations are possible at first glance: the existence of an effect due to the two-phase character of the porous medium; or the existence of a nonsaturated zone below the water table. Since the order of magnitude of the first table. Since the order of magnitude of the first effect is shown to be too small, the effect is therefore probably due to the nonsaturated zone. The interpretation of the results by taking into account such a nonsaturated zone shows that the level of the nearly saturated zone is anyoximately the the nearly saturated zone is approximately the level given by the standard elastic interpretation.

The procedure shown appears to be a very practical means of estimating the thickness of the strongly nonsaturated zone. (Brock-PTT) W89-03113

INTERPRETATION OF 'CONTROLLED' VS 'NATURAL' EXPERIMENTS IN STREAMS, California Univ., Santa Barbara. Dept. of Biologi-

Cai Sciences.

S. D. Cooper, and T. L. Dudley.
Oikos OIKSAA, Vol. 52, No. 3, p 357-361, June
1988. 1 tab, 22 ref. NSF Grant BSR 86-04808.

Descriptors: *Limnology, *Ecology, *Field tests, *Streams, *Data interpretation, Controlled experiments, Natural experiments.

Miller has criticized recent studies dealing with exploitative competition among invertebrate grazers in streams. He argued that the interpretagrazers in streams. He argued that the interpreta-tion of these experiments was confounded by arti-facts introduced by the experimental manipula-tions, and that 'natural' experiments (a posteriori correlational reanalysis of the data) provided more 'unequivocal' tests of hypotheses than could 'con-'unequivocal' tests of hypotheses than could 'controlled' experiments. In response to the first point, it is contended that the experimental artifacts postulated by Miller were unlikely to be operating, or were of little consequence, in these studies. Natural experiments, as defined by Miller, do not provide unequivocal tests of hypotheses. Previously published results, mainly from studies by McAuliffe, are reanalyzed to support the discussion. (Brock-PTT) W89-03117

HYDROLOGIC DESIGN METHODOLOGIES FOR PREFEASIBILITY STUDIES OF SMALL-SCALE HYDRO AT UNGAUGED SITES,

Acres International Ltd., Niagara Falls, NY.
D. G. Judge, J. E. Anderson, B. I. McClennan, and F. T. Park

Canadian Journal of Civil Engineering CJCEB8, Vol. 15, No. 3, p 289-298, June 1988. 7 fig, 6 tab, 12

Descriptors: *Water yield forecasting, *Reservoir yield, *Hydroelectric power, *Hydroelogy, *Streamflow, *Mathematical models, Prefeasibility studies, Small-scale hydro sites, Ungaged sites.

studies, Small-scale hydro sites, Ungaged sites.

Hydrologic variables such as available flow for electrical generation and its time distribution, together with flood magnitudes, represent the basis for evaluation of potential hydro sites. Economic viability, especially for small-scale hydro sites, is very sensitive to these basic hydrologic variables. Unfortunately, many potential small-scale hydro sites are located on ungauged streams and often the cost of deriving the necessary site-specific hydrologic information for design is prohibitive in relation to overall project costs. Therefore, regional techniques have been developed for evaluating the necessary hydrologic variables at a prefeasibility level for small-scale ungauged sites anywhere in Canada. Studies concerned with developing regional techniques for application to feasibility level evaluations have been completed for Atlantic Canada, British Columbia, and Ontario. The methodology can be used to estimate the flow duration odology can be used to estimate the flow duration curve and the turbinable flow curve for ungauged curve and the turbinable flow curve for ungauged streams. Equations relating characteristics of the curves to physiographic and climatic parameters have been derived for eleven regions across Canada. An example demonstrating application of the new methodology is included. (Author's abstract) W89-03129

NONPARAMETRIC EVALUATION OF THE SIZE OF LIMNOLOGICAL SAMPLING NETWORKS: APPLICATION TO THE DESIGN OF A SURVEY OF GREEN BAY, Argonne National Lab., IL. Biological, Environmental, and Medical Research Div.

R M Lesht

D. M. Lesht. Journal of Great Lakes Research JGLRDE, Vol. 14, No. 3, p 325-337, 1988. 10 fig, 6 tab, 14 ref. EPA Interagency Agreement DW89931897-01-0.

Data Acquisition—Group 7B

Descriptors: *Limnology, *Water sampling, *Network design, *Surveys, *Statistical methods, *Statistical analysis, *Turbidity, Evaluation, Sampling, Bays, Great Lakes.

Bays, Great Lakes.

The uncertainty associated with estimates of the volume-weighted mean turbidity in Green Bay, Lake Michigan, is examined as a function of sampling network size using a nonparametric, computer-intensive technique. As is the case for many limnological properties, the major source of variation is the nonhomogeneous (i.e., dependent on position) distribution of the sampled variable. A quantitative estimate of the expected accuracy of the volume-weighted mean is determined empirically from calculations applied repeatedly to random selections of sample data. Analysis of data from five cruises, conducted using a network of 31 stations, shows that a network of 22 stations would provide a whole-bay volume-weighted mean accurate to within 10% of that determined using the full network with 80% confidence. A network of 23 stations would achieve these same accuracy and confidence limits when applied to a model in which Green Bay is divided into four geographic zones and the volume-weighted mean calculated for each zone. The nonparametric method offers an alternative to the classic analysis of variance method for evaluation of limnological sampling designs. (Author's abstract) designs. (Author's abstract) W89-03174

ESTUARIES: CONCERN OVER TROUBLED WATERS.

S. Morrissey

Oceans, Vol. 21, No. 3, p 23-26, 61, June 1988.

Descriptors: *Estuaries, *Population effects, *Water pollution, *Water pollution sources, *Urbanization, *Monitoring, *Nonpoint pollution sources, Satellite technology, Forecasting, Tissue analysis, Eutrophication, Polychlorinated biphen-

yls.

The efforts of the National Oceanic and Atmospheric Administration (NOAA) to control the effects of nonpoint pollution on estuaries are discussed. Estuaries are being transformed by the effects of a population explosion and the U.S. Census Bureau predicts that, by 1990, 75% of the U.S. population will live within 50 miles of a coastline. Under the guidance of Bud Ehler, director of NOAA's Oceanography and Marine Assessment Office, the agency has been collecting information on nonpoint sources of pollution in estuaries nationwide. Using digitized satellite photographs and direct samplings, NOAA has established a data base containing detailed information on the extent of chemical pollution, in estuaries. The scientists measure more than 50 organic chemicals and 17 heavy metals. Samplings of shell-fish, bottom-feeding fish and sediments have been taken from 150 sites in an attempt to establish the degree of toxic contamination. Although NOAA scientists say nothing can be done to eliminate the present conditions altogether, they do hope to scientists say nothing can be done to eliminate the present conditions altogether, they do hope to have a computerized network in place within the next five years that will forecast when and where problems will occur. The network would provide data on marine life, pollution, habitats, oceanography, and meteorology to assist community planners to determine the areas best suited for development and will improve NOAA's ability to predict shore erosion, storm surges and jubilees. (Miller-W89-03279

7B. Data Acquisition

RESPIRATION-BASED EVALUATION OF NI-TRIFICATION INHIBITION USING EN-RICHED NITROSOMONAS CULTURES, Purdue Univ., Lafayette, IN. School of Civil Engi-

neering.
J. E. Alleman.

IN: International Conference on Innovative Biological Treatment of Toxic Wastewaters. June 24-26, 1986, Arlington, Virginia. April 1987. p 643-651, 5 fig. 1 tab, 7 ref.

Descriptors: *Wastewater treatment, *Wastewater analysis, *Respiration, *Nitrification, *Nitrogen bacteria, *Bioassays, Biomonitoring, Industrial wastewater, Monitoring, Biological studies.

The enriched Nitrosomonas bioassay procedure described in this paper has proven to be an extremely useful, expedient, and cost-effective mechanism for rapid evaluation of wastewater toxicity. Extending beyond this immediate application, the procedure has been employed for investigative evaluations of suspected industrial waste generators. Furthermore, this test has been successfully used to diagnostically determine appropriate dilution levels for industrial waste streams at their respective sewer outfalls. Although this bioassay may be completed with either respirometric (based on OUR) or colorimetric (based on NH4-N oxidation rates) analyses, the OUR strategy appears preferable due to its simplicity. Monitoring of the ammonium-nitrogen oxidation rate with a colorimetric NH4-H test requires tedious sample clarifipreterable due to its simplicity. Monitoring of the ammonium-nitrogen oxidation rate with a colorimetric NH4-H test requires tedious sample clarification and treatment. Within an 8 hr workday, 2 laboratory technicians can routinely complete between 100 and 120 biacosaay tests based on the OUR procedure; this number of samples is approximately 4 times larger than that which can be managed with the colorimetric procedure. As with any bioassay procedure, questions may be raised about the inherent reliability and veracity of the tests. In the particular case of its use by the City of Indianapolis, however, the enriched Nitrosomonas bioassay technique has proven to be an excellent indicator procedure. (See also W89-02267) (Lantz-PITT)

INNOVATIVE DESIGNS FOR WATER QUALITY MONITORING: ARE WE ASKING THE QUESTIONS BEFORE THE DATA ARE COL-LECTED.

Minnesota Univ., St. Paul. Dept. of Forest Re-For primary bibliographic entry see Field 7A. W89-02320

COASTAL MONITORING: EVALUATION OF MONITORING METHODS IN NARRAGAN-SETT BAY, LONG ISLAND SOUND AND NEW SETT BAY, LONG ISLAND SOUND AND NEW YORK BIGHT, AND A GENERAL MONITOR-ING STRATEGY, Environmental Protection Agency, Narragansett, RI. Environmental Research Lab. For primary bibliographic entry see Field 5A. W89-02325

'MUSSEL WATCH'-MEASUREMENTS OF CHEMICAL POLLUTANTS IN BIVALVES AS ONE INDICATOR OF COASTAL ENVIRON-

MENTAL QUALITY,
Woods Hole Oceanographic Institution, MA.
Coastal Research Center.
For primary bibliographic entry see Field 5A.
W89-02326

GAS CHROMATOGRAPHIC RESIDUE PAT-TERNS OF TOXAPHENE IN FISH SAMPLES FROM THE GREAT LAKES AND FROM RIVERS OF THE SOUTHEASTERN UNITED

STATES, Columbia National Fisheries Research Lab., MO. For primary bibliographic entry see Field 5B. W89-02328

MEASUREMENT OF GROUNDWATER VE-LOCITY WITH A COLORIMETRIC BORE-HOLE DILUTION INSTRUMENT, Weston (Roy F.), Inc., West Chester, PA. J. J. Dexter, and P. M. Kearl. IN: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 251-268, 7 fig. 4 tab, 6 ref.

Descriptors: *Borehole dilution instrument, *Tracers, *Measuring instruments, *Groundwater movement, *Geohydrology, Hydrology, Aquifers, Performance evaluation, Calibrations, Field tests, Dry

A borehole dilution instrument was constructed A borehole dilution instrument was constructed that measures dilution of a dye tracer in a test section isolated by packers. Light is transmitted by a colorimeter vta fiber optics to a down-hole probe. Test section fluid is continuously pumped through the probe where the light is partially absorbed before travelling back to the surface. As groundwater dilutes the dye, the amount of light absorbance decreases. Results from this investigation indicate that the borehole dilution instrument has the capability to delineate zones of different permeabilities within an aquifer. The instrument was calibrated in a flow tank and field tested at two hydrogeologically different sites. Site I aquifer was calibrated in a flow tank and field tested at two hydrogeologically different sites. Site 1 aquifer consists of sand and gravel while the Site 2 aquifer consists of clayer silt. At Site 1, borehole dilution yields results that are comparable to pumping tests and artificial gradient tracer tests. Problems due to calibration and background absorbance were most pronounced at Site 2. Borehole dilution ground-water velocities obtained there were one to two orders of magnitude higher than values calculated from pumping and natural gradient tracer tests. (See also W89-02331) (Author's abstract) W89-02345. W89-02345

ROLE OF AQUIFER TESTING IN DESIGN OF CONSTANT-HEAD EXTRACTION SYSTEMS, Pacific Environmental Group, Inc., Santa Clara, CA.

W. M. Crell, and R. Wenzlau.

W. M. Creil, and R. Wenziau.
In: Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin, OH. 1988. p 269-279, 6 fig. 7 ref.

Descriptors: *Groundwater movement, *Pumping tests, *Water pollution treatment, *Groundwater management, *Extraction systems, *Aquifer testing, Geohydrology, Hydrology, Water level fluctuations, Seasonal variation.

Aquifer testing plays a vital role in the design and implementation of any remedial extraction system. The traditional approach of aquifer testing evaluates aquifer characteristics under constant-flow conditions while most extraction systems operate under a constant-head. A variety of aquifer test strategies are available which, when correctly applied within a given hydrogeologic environment, can provide an accurate reflection of the local hydrogeology and be the basis for design of constant-head extraction systems. However, misapplication of aquifer testing and analyses in the design of a constant-head extraction system can result in an inefficient or largely inoperable system. Constant-discharge tests, commonly used to evaluate quifer characteristics, typically provide aquifer characterization under fully stressed conditions which are rarely induced by a constant-head extraction system. For a constant-head system, capwhich are rarely induced by a constant-head ex-traction system. For a constant-head system, cap-ture zones should be derived while maintaining a water level in the well which is close to the proposed constant-head elevation. Since steady-state conditions are rarely maintained during aquistate conditions are rarely maintained during aqui-fer testing, design projections must account for factors which may include seasonal fluctuations, delayed yield, a decrease in transmissivity over time, and/or a decrease in the area of capture due to lowering of the water table. Aquifer test strate-gies should also include the derivation of an opti-num pump discharge rate to minimize pump cy-cling. Improper adjustment of pump cycling can reduce the effective area of influence or precipitate pump failure. (See also W89-02331) (Author's ab-stract) W89-02346

IMPROVED FRESH WATER ASSESSMENT IN SAND AQUIFERS UTILIZING GEOPHYSICAL

ResTech Houston, Inc., TX. For primary bibliographic entry see Field 2F. W89-02347

RECOGNIZING PETROLEUM HYDROCAR-BON CONTAMINATION IN THE VADOSE ZONE WITH PHOTOIONIZATION DETEC-TION SCANNING OF FIELD SAMPLES,

Group 7B-Data Acquisition

Pirnie (Malcolm), Inc., Phoenix, AZ. For primary bibliographic entry see Field 5A. W89-02351

APPLYING ELECTRICAL RESISTANCE BLOCKS FOR UNSATURATED ZONE MONI-TORING AT ARID SITES,

EMCON Associates, San Jose, CA.
J. P. Hayes, and D. C. Tight.
IN: Proceedings of the FOCUS Conference on
Southwestern Ground Water Issues. National
Water Well Association, Dublin, OH. 1988. p 375395, 8 fig. 1 tab, 9 ref.

Descriptors: *Leak detection, *Electrical resistance blocks, *Measuring instruments, *Groundwater monitoring, *Path of pollutants, Water pollution sources, Lysimeters, Calibrations, Field tests, Aquifers, Analytical methods, Groundwater

Potential applications of electrical resistance blocks include moisture front (leak) detection beneath surface impoundments or landfills, leak de-tection beneath pipelines, evaluation of the feasibility of lysimeter operation, or guidance for timing lysimeter sampling events. Electrical resistance block readings are most accurate in dry soils at soil-water pressure ranging from -0.8 to -15 bars. Because this is below the functional range of most tensiometers and lysimeters, electrical resistance blocks can be effective additions to monitoring systems in dry areas where low soil-water pressure is expected. The effectiveness of gypsum blocks is being evaluated at a southern California landfill site, using grouped installations of gypsum block and tensiometers. Gypsum blocks were placed in soil and bedrock settings and will be calibrated and tested over several months. Preliminary data inditested over several months. Preliminary data indi-cate that water added during installation can influ-ence results for a substantial period (months): therefore, dry installation techniques are being tested. Other potential limitations to the use of electrical resistance blocks include changes in the electrical response when exposed to saline solu-tions, dissolution of the gypsum over time, prob-lems establishing good contact between the block and the native soil, and hysteresis variations that can affect calibrated soil-moisture values. Despite these limitations, electrical resistance block may be effectively applied to monitoring systems at arid sites. (See also W89-02331) (Author's abstract) W89-02352

HYDROGEOLOGICAL MAPPING IN ASIA AND THE PACIFIC REGION. Verlag Heinz Heise, Hannover, West Germany. Proceedings of the ESCAP-RMRDC Workshop, Bandung, 1983. International Contributions to Hydrogeology Volume 7. 1985. 4(l)p. Edited by W. F. Grimmelman, K. D. Krampe, and W. Struckmeier.

Descriptors: *Hydrogeology, *Asia, *Pacific region, *Mapping, *Hydrologic maps, *Groundwater, *Geohydrology, *Surface water, Hydrography, Groundwater availability, Surface-groundwater relations, Irrigation, Watersheds, Aquifers, Groundwater potential, Groundwater irrigation, Groundwater moment, Groundwater moment, Groundwater moment, Water table fluctuations, Groundwater recharge.

The 1983 workshop of the Economic and Social Commission for Asia and the Pacific Regional Mineral Resources Development Centre covers the following topics: the assessment, development, the following topics: the assessment, development, and mapping of groundwater resources in Australia, Füji, the Solomon Islands, the Kingdom of Tonga, Vanuatu, the Democratic Republic of Korea, China, Indonesia, peninsular Malaysia, Sarawak, the Mongolian People's Republic, the Butwal-Bhairaltwa Area, Lumbini Zone, Nepal, Pakistan, the Philippines, Sri Lanka, Thailand, South and East Asia, and the Socialist Republic of Vietnam; principles and application of the international egend for hydrogeological maps; the organization of hydrogeological maps of karstic terrains; hydrogeological maps of karstic terrains; hydrogeological mapping programs; report on hydrogeological maps of karstic terrains; hydrogeological mapping in coastal areas; hydrogeological mapping in coastal areas; hydrogeological

cal maps from the viewpoint of the user; minimum data requirements for the preparation of hydrogeo-logical maps, and problems of small island nations; discussion on the revised international legend for discussion on the revised international legend for hydrogeological maps, and hydrogeological prob-lems in coastal areas; water-bearing zones in the mining area of the northern region of Bangladesh with regard to utilization of mine water for irrigation and other uses; the assessment of hydrogeological features using the technique of terrain classification; and hydrogeological problems of hard rock areas of southern India. (See W89-02365 thru W89-02391) (Davis-PTT)

ASSESSMENT AND MAPPING OF AUSTRA-LIA'S GROUNDWATER RESOURCES, Bureau of Mineral Resources, Geology and Geo-physics, Canberra (Australia). For primary bibliographic entry see Field 2F. W89-02365

HYDROGEOLOGICAL MAPPING IN FIJI, Department of Mineral Resources, Suva (Fiji). For primary bibliographic entry see Field 2F.

POSITION PAPER: SOLOMON ISLANDS, Ministry of Lands, Energy and Natural Resources, Honiara (Solomon Islands). For primary bibliographic entry see Field 2F. W89-02367

HYDROGEOLOGICAL DEVELOPMENT IN

HYDROGEOLOGICAL DEVELOPMENT IN VANUATU,
Department of Geology, Mines, and Rural Water Supplies, Vila (Vanuatu).
For primary bibliographic entry see Field 2F. W89-02368

WATER-BEARING ZONES IN THE MINING AREA OF THE NORTHERN REGION OF BAN-GLADESH WITH REGARD TO UTILIZATION OF MINE WATER FOR IRRIGATION AND OTHER USES,
Bangladesh Mineral Exploration and Development

Corp. Dacca.
For primary bibliographic entry see Field 2F.
W89-02369

DEVELOPMENT AND ACHIEVEMENTS OF HYDROGEOLOGICAL MAPPING IN CHINA, Ministry of Geology and Minerals, Beijing (China). Advisory Committee on Geology Science and Technology. For primary bibliographic entry see Field 2F. W89-02370

GROUNDWATER IN CHINA, Zhengding Inst. of Hydrogeology and Engineering Geology (China). For primary bibliographic entry see Field 2F.

ASSESSMENT OF HYDROGEOLOGICAL FEA-

TURES USING THE TECHNIQUE OF TER-RAIN CLASSIFICATION, Hong Kong Public Works Dept. Geotechnical Control Office.

K. A. Styles, and A. D. Burnett. In: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p. 121-144, 11 fig, 1 tab, 5

Descriptors: *Land management, *Hydrogeology, *Mapping, *Terrain analysis, *Hong Kong, *Geomorphology, Monitoring, Feasibility studies.

Systematic terrain classification is an extremely Systematic terrain classification is an extremely powerful reconnaissance tool that can assist hydrogeological investigations. The preparation of hydrogeological maps and the design of monitoring programs can be expedited by the use of terrain classification maps in conjunction with existing

geological data. Detailed preliminary assessment of project requirements enables economy in data col-lection. The general format provided by the terrain classification approach at a regional level is relevant for the preparation of hydrogeological maps for resource development on the one hand and more specific problems solving on the other. General areas of problematical hydrogeology are delineated at the regional level and subsequently, indi-vidual problems can be pin-pointed by detailed vidual problems can be pin-pointed by detailed terrain classification for site investigation and monitoring. Terrain classification provides a system for the preparation of land inventory and is well suited for developing countries because its application need not be restricted to a single purpose. The regional system described in this paper could be as readily applied to agricultural or urban capability classification, borrow resourc estimation on materials assessment as it is to hydrogeological analyses or geotechnical suitability. This paper discusses the system of regional and detailed terrain classification used by the Geotechnical Control Office of the Hong Kong Government to assist the assessment of engineering feasibility for planning and ment of engineering feasibility for planning and land management purposes. The features of the mapping system which have hydrogeological ap-plications are highlighted. (See also W89-02364) (Davis-PTT) W89-02372

GROUNDWATER RESOURCES DEVELOP-MENT AND MANAGEMENT IN INDIA, Central Ground Water Board, New Delhi (India).

For primary bibliographic entry see Field 2F W89-02373

HYDROGEOLOGICAL PROBLEMS OF HARD ROCK AREAS OF SOUTHERN INDIA.

Deutsche Gesellschaft fuer Windenergie e.V., Hamburg (Germany, F.R.). For primary bibliographic entry see Field 2F. W89-02374

STATUS OF HYDROGEOLOGICAL MAPPING IN INDONESIA IN 1983,

R. Soekardi, and S. Sustrisno.

IN: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p 157-164, 1 fig, 1 tab, 4 ref.

Descriptors: *Hydrogeology, *Indonesia, *Mapping, *Hydrologic maps, *Groundwater.

Due to an increasing demand of water for many purposes (drinking water, irrigation and industry) Indonesia needs more information on groundwater resources as an alternative for water supply. Thus, hydrogeological maps are required for regional development planning, since they provide basic data on the occurrence of groundwater, aquifer productivity, groundwater quality and other groundwater related information. Hydrogeological maps transfer hydrogeological knowledge to local government planners, public authorities, water supply companies, or private users. The map sheetts, scale 1:250 000, generally cover 1 degree 30 minutes longitude and 1 degree latitude, i.e. an area of more than 18 000 square km. The scale of 1:250 000 was determined to be the most appropriate for the map, because it copes best with the following aims and boundary conditions. (1) clear and exact representation of the hydrogeological data for fairly large areas; (2) ability to complete the maps by reasonable means and in relatively short time; and (3) availability of recent topographic and geological base maps. The whole map series of the hydrogeological map of Indonesia will comprise more than 150 sheets. The maps are published in two languages, Bahasa Indonesia and English. Editing of the sheets is done in the hydrogeological mapping sections of the Directorate of Environmental Geology, while cartographic production and print is conducted by the publication section of Geologica Research and Development Centre. The field work has been completed on all of them and about half have been edited. Two maps from Java and four from Bali and Nusa Tenggara have been published. (See also W89-02364) (Davis-PTT) W89-02375 purposes (drinking water, irrigation and industry) Indonesia needs more information on groundwater

RESOURCES DATA—Field 7

Data Acquisition—Group 7B

REVIEW OF GROUNDWATER IN THE RE-PUBLIC OF KOREA, Korean Inst. of Energy and Resources, Seoul (Re-public of Korea). Applied Geology Div. For primary bibliographic entry see Field 2F. W89-02376

STATUS OF HYDROGEOLOGICAL MAPPING IN PENINSULAR MALAYSIA, Geological Survey of Malaysia, Ipoh. Hydrogeo-logy Div.

For primary bibliographic entry see Field 2F. W89-02377

NOTES ON THE HYDROGEOLOGICAL MAP OF SARAWAK.

Geological Survey of Malaysia, Kuching. Hydrogeological salvey of Manysia, Ruching, Figeology Section.
For primary bibliographic entry see Field 2F.
W89-02378

WATER RESOURCES AND HYDROGEOLOGI-CAL MAPPING IN THE MONGOLIAN PEO-PLE'S REPUBLIC,

Ministry of Water Economy, Ulan Bator (Mongolia). For primary bibliographic entry see Field 2F. W89-02379

HYDROGEOLOGY OF THE BUTWAL-BHAIR-AHWA AREA, LUMBINI ZONE, NEPAL, Department of Mines and Geology, Kathmandu (Nepal).

For primary bibliographic entry see Field 2F. W89-02380

PAKISTAN-STATUS REPORT, Pakistan Water and Power Development Author-For primary bibliographic entry see Field 4B. W89-02381

HYDROGEOLOGICAL MAPPING IN THE PHILIPPINES, Bureau of Mines and Geo-Sciences, Manila (Philip-

Pines).
For primary bibliographic entry see Field 2F.
W89-02382

DEVELOPMENT OF GROUNDWATER RE-SOURCES IN SRI LANKA, National Water Supply and Drainage Board, Co-lombo (Sri Lanka).

For primary bibliographic entry see Field 4B. W89-02383

STATUS OF HYDROGEOLOGICAL MAPPING IN THAILAND,

Land Development Dept., Bangkok (Thailand). Soil Survey Div. For primary bibliographic entry see Field 2F. W89-02384

HYDROGEOLOGICAL MAPPING IN THE SO-CIALIST REPUBLIC OF VIETNAM. For primary bibliographic entry see Field 4B. W89-02385

INTERNATIONAL LEGEND FOR HYDRO-GEOLOGICAL MAPS: PRINCIPLES AND AP-PLICATION, Bundesanstalt fuer Geowissenschaften und Roh-

stoffe, Hanover (Germany, F.R.). W. Struckmeier.

N. Stackinieria. In: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p. 251-262, 1 fig, 1 tab, 10

Descriptors: *Hydrogeology, *Mapping, *Hydrologic maps, *Standards, *Groundwater availability, *Geohydrology, Surface water, Surface-groundwater relations, Groundwater.

Early attempts at a standardization of the graphical Early attempts at a standardization of the graphical representation on hydrogeological maps originate from the 1950s and were first published in 1963 in an 'International Legend for Hydrogeological Maps' (Unesco). The present paper expounds the usefulness of a standard legend for hydrogeological maps and outlines it development from the first theoretical considerations of the 1963 legend to the representation scheme of the revised legend of 1983, which has been tested in practice over large areas of Europe and in various environments. By and large, the legend applies to general hydrogeological maps which integrate information on areas of Europe and in various environments. By and large, the legend applies to general hydrogeological maps which integrate information on groundwater resources, geology (lithology, structures) and i ydrogeological features (groundwater and springs, water quality and temperature, surface water, karst, permafrost, horizon contours, manmade features). A large number of signs and symbols are also recommended for use on more specialized and detailed hydrogeological maps. It is recognized, however, that these detailed maps frequently require special representations to underline their special purpose. General hydrogeological maps can be used for many purposes and by numerous map users, such as administrators, economists, engineers, technicians, scientists, teachers, farmers, and private individuals. The important role of the standard legend as a common legend mediating between the specialists in the field of hydrogeology the technical level and the interest-equibilic is stressed. The legend, meanwhile international scale and in industrialized or developing countries, as many recent examples reveal. (See also W89-02364) (Author's abstract) countries, as many recent examples reveal. (See also W89-02364) (Author's abstract) W89-02386

DATA REQUIREMENTS FOR HYDROGEOLO-GICAL MAPS, Bundesanstalt fuer Geowissenschaften und Roh-

For primary bibliographic entry see Field 7A. W89-02387

ORGANIZATION OF HYDROGEOLOGICAL MAPPING PROGRAMS, Geological Survey of Western Australia, Perth.

Dept. of Mines.
T. T. Bestow.
IN: Hydrogeological Mapping in Asia and the Pacific Region. Verlag Heinz Heise, Hannover, West Germany. 1985. p. 293-299.

Descriptors: *Hydrogeology, *Mapping, *Maps, Groundwater, Data interpretation.

Hydrogeological mapping supports development and its cost is small in relation to the long term benefits. Program planning must take account of priorities and the availability of geological and groundwater information. The objectives should be clarified in order to optimize the data to be included in the final publication and its style. Compromise and data selection are necessary if maps are to retain clarity. Scales must be chosen in relation to objectives, data availability and the hydrogeological environment. (See also W89-02364) (Author's abstract)

REPORT ON HYDROGEOLOGICAL MAPS OF

KARSTIC TERRAINS, International Association of Hydrogeologists, Paris (France).

For primary bibliographic entry see Field 2F. W89-02389

HYDROGEOLOGICAL MAPPING IN COAST-

AL AREAS, Rijks Geologische Dienst, Haarlem (Netherlands). For primary bibliographic entry see Field 2F. W89-02390

HYDROGEOLOGICAL MAPS FROM THE VIEW-POINT OF THE USER,

International Association of Hydrogeologists, Paris

For primary bibliographic entry see Field 7A. W89-02391

PERFORMANCE OF ANALYTICAL TEST KITS ON METAL FINISHING WASTEWATER SAM-PI FS

Scientific Control Labs., Inc., Chicago, IL For primary bibliographic entry see Field 5D. W89-02403

NATIONAL SURFACE WATER SURVEY, WESTERN LAKE SURVEY (PHASE 1 - SYN-OPTIC CHEMISTRY) QUALITY ASSURANCE

Lockheed Engineering and Management Services Co., Inc., Las Vegas, NV. For primary bibliographic entry see Field 2H. W89-02413

NUMERICAL MODEL FOR THE COMPUTA-TION OF RADIANCE DISTRIBUTIONS IN NATURAL WATERS WITH WIND-ROUGH-ENED SURFACES, PART II: USER'S GUIDE AND CODE LISTING,

Joint Inst. for the Study of the Atmosphere and Ocean, Seattle, WA. For primary bibliographic entry see Field 2H. W89-02414

HYDROLOGY IN PRACTICE, Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering. For primary bibliographic entry see Field 2A. W89-02421

RIVER BED GRAVELS: SAMPLING AND

British Columbia Univ., Vancouver. Dept. of Geography.

M. A. Church, D. G. McLean, and J. F. Wolcott.

IN: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 43-88, 17 fig, 3 tab, 50 ref.

Descriptors: *Alluvial channels, *Bed load samplers, *Gravel, *Sampling, *Fluvial sediments, Data interpretation, Particle size, River beds, Models, Sediment transport, Comparison studies, Statistical methods, Sieve analysis.

The characterization of coarse bed material in rivers is difficult because the range of grain sizes is so wide that it is impractical to maintain a single method of measurement. Less obvious problems include the establishment of criteria for sample size, accounting for the layered nature of deposits and characterizing structural features of the bed.
The latter include imbrication, particle clustering
and shadow deposits. Standards for sample size in various measurement techniques are considered. Measurement methods are reviewed and the notion of truncated samples is introduced as a means to overcome sample bias at the extremes of the size range. Replicability in sampling and analysis, fundamental desiderata for scientific measurements, are examined. Strategies are considered to achieve representative samples of satisfactory precision for various purposes, and the problem posed by layers, various purposes, and the problem posed by layers, particularly surface/subsurface contrasts, is intro-duced. Because bed material samples are drawn from a very large and variable population, it is customary to interpret their meaning statistically. Since statistics is based upon number counts, this procedure may be applied within samples when individual clasts are measured: however, custom-ary sieve procedures, wield frequency by weight. individual clasts are measured: nowever, custom-ary sieve procedures yield frequency by weight, which is not a well-conditioned statistical entity. Transformations are unhelpful in practice since the numbers become absurdly large for small clasts. Strategies for interpreting these measurements are considered. (See also W89-02430) (Author's abstract) W89-02433

Group 7B-Data Acquisition

BED LOAD TRANSPORT MEASUREMENTS BY THE VORTEX-TUBE TRAP ON VIRGINIO

BY THE VORTEX-TUBE TRAP ON VIRGINIO CREEK, ITALY, Florence Univ. (Italy). Dept. of Civil Engineering. P. Tacconi, and P. Billi.
IN: Sediment Transport in Gravel-Bed Rivers. John Wiley and Sons, New York. 1987. p 583-616, 16 fig. 2 tab, 14 ref.

Descriptors: "Alluvial channels, "Bed load samplers, "Sediment transport, "Bed load, "Sediment sampler, Particle size, Italy, Sampling, Flood discharge.

The first measurements made during the years 1983-1985 on Virginio Creek, which was equipped with a vortex-tube trap for the total and continuous measurement of bed load, have demonstrated the pulsating nature of bed load transport and the very low correlations between flow, bed load and grain size characteristics of the sediments. In other experiments in a 400 m reach upstream of the measuring station, a few characteristics, such as measuring station, a few characteristics, such as cross-section geometry, bed forms and grain size distribution of the armor and subarmor layers, are surveyed in order to correlate them to the measured bed load transport parameters. In April 1983 the surfaces of two side bars occurring just upstream of the station were spray-painted and in June of the same year marked pebbles were placed on the stream bed in equi-distant sections making possible the observation of the evolution of the channel and the bars, the measurement of the average distance moved by the marked pebbles, and the relation of this to the features of bed load events. Some preliminary observations of these experi-Some preliminary observations of these experiments are reported. (See also W89-02430) (Author's abstract)

METHODS FOR HYDROLOGIC MONITOR-ING OF SURFACE MINING IN THE CEN-TRAL-WESTERN UNITED STATES,

Geological Survey, Denver, CO. Water Resources Div. For primary bibliographic entry see Field 7A. W89-02490

DISCHARGE RATINGS FOR CONTROL STRUCTURES AT MCHENRY DAM ON THE FOX RIVER, ILLINOIS, Geological Survey, De Kalb, IL. Water Resources

Div

G. G. Fish Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 87-4226, 1988. 29p, 10 fig, 6 tab, 2 ref.

Descriptors: *Discharge ratings, *Discharge coefficient, *Streamflow, *Discharge measurements, *Dams, Orifice flow, Weirs, McHenry, Illinois,

Twenty-three measurements of discharge were used to determine discharge ratings for the five adjustable sluice gates, spillway, and fish ladder at McHenry Dam on the Fox River in Illinois. A discharge rating for free weir flow over the spillway and fish ladder was based on four measurements of discharge that ranged from 169 to 2.990 cubic feet per second. Discharge ratings for free weir, free orifice, and submerged orifice flow under the sluice gates were based on 19 measurements of discharge that ranged from 180 to 4,050 cubic feet per second. Hydraulic conditions that identify flow regimes at McHenry Dam are defined by ratios between headwater depth (h1), tailwater depth (h3), and gate opening (hg). Flow under the sluice gates is identified as weir flow when ratio of gate opening to headwater depth is greater than 0.73. And as orifice flow when hg/h1 is less than 0.73. Free orifice flow occurs when the ratio of tailwater depth to gate opening is less than ratio of tailwater depth to gate opening is less than 1.3, and submerged orifice flow occurs when ha/ hg is greater than 1.3. Flow under the sluice gates is identified as free weir flow when the ratio of tailwater depth to headwater depth is less than 0.75, and as submerged weir flow when hs/h is greater than 0.75. Flow over the spillway is identified as free weir flow when the ratio of tailwater depth to headwater depth is less than 0.60, and as

submerged weir flow when h3/h1 is greater than 0.60. (USGS) W89-02494

CONSTRUCTION, GEOLOGIC, AND HYDRO-LOGIC DATA FOR OBSERVATION WELLS IN THE REELFOOT LAKE AREA, TENNESSEE AND KENTUCKY.

Geological Survey, Nashville, TN. Water Resources Div.

sources Div.
M. W. Bradley.
Available from OFSS, USGS, Box 25425, Denver,
CO 80225. USGS Open-File Data Report 87-249,
1987. 17p., 1 fig. 3 tab, 2 ref.

Descriptors: *Hydrologic data, *Geohydrology, *Groundwater, *Alluvial aquifer, *Tennessee, Lithology, Well construction, Specific capacity, Water quality, Reifoot Lake, Lake County, Fulton County, Kentucky.

Twenty-three observation wells were installed at 12 sites in the Reelfoot Lake area of Kentucky and Tennessee during July 1986. The wells were installed to supplement an existing water level network and to provide additional data on the hywork and to provide additional data on the hydraulic characteristics and vertical hydraulic gradients in the alluvial aquifer near Reelfoot Lake. Well yields ranged from less than 20 gallons per minute to about 140 gallons per minute. The specific capacities of the wells ranged from less than 1 to 17.1 gallons per minute per foot of drawdown. Dissolved-solids concentrations ranged from 153 to 475 milligrams per liter at six wells. Three lithological sequences were encountered during the control of the control o lithological sequences were encountered during drilling. Deep clay and silty clay occurred near the southwest corner of Reelfoot Lake. Predominantly southwest corner of Reelfoot Lake. Predominantly medium- to coarse-grained sand occurred below about 15 feet of silt and clay near the west and northwest sides of the Lake. Along the western limit of the study area, near Lake No. 9 and the Mississippi River, at least about 50 feet of silt and silty sand occurred below land surface. (USGS) W89-02510

DATA-COLLECTION METHODS AND DATA SUMMARY FOR THE ASSESSMENT OF WATER QUALITY IN CEDAR CREEK, WEST-CENTRAL ILLINOIS, Geological Survey, Urbana, IL. Water Resources Discourage Control Control Control Control Control Control

R. D. McFarlane, W. O. Freeman, and A. R.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-543, 1987. 177p, 14 fig, 17 tab, 21 ref.

Descriptors: *Water quality, *Urban runoff, *Combined-sewer overflows, *Data acquisition, *Illinois, Waste assimilative capacity, Storms, Low flow. Streamflow.

A water-quality data-collection network on a 26.2 mile reach of Cedar Creek in west-central Illinois was operated from May through December 1985 and from March through October 1986. The study reach drained predominantly agricultural land; however, the city of Galesburg contributes combined- and storm-sewer discharge to the creek that can affect the water quality. Streamfour and water can affect the water quality. Streamflow and water quality data-collection techniques are described, along with the methods and the instrumentation along with the methods and the instrumental used. This report describes methods for measuring used. This report describes methods for measuring used. stage, discharge, precipitation, sediment oxygen demand, traveltime, and reaeration rate. Collection methods for bottom-material samples. 24-hour ater quality data, combined-sewer overflow frequency and duration, and storm-related sampling of combined sewers, storm sewers, and stream are described. A brief discussion of streamflow computation methods is also presented. (USGS)

WATER QUALITY OF RUNOFF TO THE CLARKSVILLE MEMORIAL HOSPITAL DRAINAGE WELL AND OF MOBLEY SPRING, CLARKSVILLE, TENNESSEE, FEBRUARY-MARCH 1988, Geological Survey, Nashville, TN. Water Resources Div.

For primary bibliographic entry see Field 5B. W89-02556

QUALITY OF GROUNDWATER IN SHALLOW WELLS IN AGRICULTURAL AREAS OF HAY-WOOD, SHELBY, LAKE, AND OBION COUN-TIES, TENNESSEE, JANUARY-FEBRUARY

Geological Survey, Nashville, TN. Water Resources Div. For primary bibliographic entry see Field 5B. W89-02557

WATER RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN MISSOURI, FISCAL YEAR 1987.
Geological Survey, Rolla, MO. Water Resources

For primary bibliographic entry see Field 9C.

W89-02567

METHODS FOR COLLECTION AND ANALY-SIS OF AQUATIC BIOLOGICAL AND MICRO-BIOLOGICAL SAMPLES,

Geological Survey, Lakewood, CO. Water Resources Div.

SUITCES LIV.

L. J. Britton, and P. E. Greeson.

Available from OFSS, USGS, Box 25425, Denver,

CO 80225. USGS Open-File Report 88-190, 1988.

685p, 66 fig. 22 tab, 2900 ref.

Descriptors: *Aquatic life, *Biological samples, *Sampling, *Data collections, Preservation, Bacteria, Phytoplankton, Zooplankton, Benthic fauna, Fish, Chlorophyll, Bioassay, Primary productivity, Macrophytes, Stream, Lakes, Estuaries, Taxono-

Chapter A4, methods for collection and analyses of aquatic biological and microbiological samples, contains methods used by the U.S. Geological Survey to collect, preserve, and analyze waters to determine their biological and microbiological properties. Part I consists of detailed descriptions of more than 45 individual methods, including those for bacteria, phytoplankton, zooplankton, seston, periphyton, macrophytes, benthic invertebrates, fish and other vertebrates, cellular contents, brates, fish and other vertebrates, cellular contents, productivity and bioassay. Each method is summarized, and the applications, interferences, apparatus, reagents, analyses, calculations, reporting of results, precisions, and references are given. Part 2 consists of a glossary. Part 3 is a list of taxonomic references. (USGS)
W89-02568

GEOPHYSICAL LOGS AND HYDROLOGICAL DATA FOR EIGHT WELLS IN THE COYOTE SPRING VALLEY AREA, CLARK AND LINCOLN COUNTIES, NEVADA,

Geological Survey, Carson City, NV. Water Resources Div. For primary bibliographic entry see Field 4B. W89-02603

SNOW WATCH '85.

Lamont-Doherty Geological Observatory, Pali-For primary bibliographic entry see Field 2C.

PROGRESSION OF REGIONAL SNOW MELT, Lamont-Doherty Geological Observatory, Palisades, NY.

For primary bibliographic entry see Field 2C. W89-02610

SNOW COVER RECORD IN EURASIA, National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center. For primary bibliographic entry see Field 2C. W89-02612

DISTRIBUTION OF SNOW COVER IN CHINA.

RESOURCES DATA—Field 7

Data Acquisition—Group 7B

Academia Sinica, Lanzhou (China). Lanzhou Inst. of Glaciology and Cryopedology.

For primary bibliographic entry see Field 2C.

SNOW SURVEYING IN CANADA,

Canadian Climate Centre, Downsview (Ontario).

Canadian Climate Centre, Downsview (Ontario). B. E. Goodison. Available from the National Technical Information Service, Springfield, VA 22161, as DE36-011983. Price codes: A12 in paper copy; A01 in microfiche. IN: Snow Watch '85. Glaciological Data Report GD-18. March 1986. p 97-103. 1 fig, 2 tab, 11 ref.

Descriptors: *Snow cover, *Satellite technology, *Remote sensing, *Meteorological data collection, *Climatology, *Canada, Carbon dioxide, Maps.

Snow cover data for Canada are available from ground, airborne or satellite surveys. The conven-tional ground observations of daily snow depth at synoptic and climate stations and weekly, bitional ground observations of daily snow depth at synoptic and climate stations and weekly, bi-weekly or monthly snow surveys at more than 1200 snow course sites form the basic snow cover network. The current and future availability of these data and some of the problems in using the data are outlined. It is not unreasonable to expect the number of snow courses operating in Canada will decline in the future. Development of alternative methods, notably airborne gamma-ray surveys of water equivalent and satellite determination of areal extent, and more recently, depth and water equivalent, are necessary. The status of these methods are summarized. Initial results of a study to assess the applicability of passive microwave data for mapping snow cover have been encouraging. It offers a method for collecting snow cover data over large areas often lacking data from conventional methods. These data are generally collected for hydrological rather than climatological applications. Some questions related to their use in addressing the questions of carbon dioxide/snow interaction are raised for further discussion. (See also W89-02606) (Sand-PTT)

NORTHERN HEMISPHERE SNOW AND ICE CHART OF NOAA/NESDIS, National Environmental Satellite, Data, and Infor-mation Service, Washington, DC. For primary bibliographic entry see Field 2C. W89-02616

NOAA SATELLITE-DERIVED SNOW COVER DATA BASE: PAST, PRESENT, AND FUTURE, National Environmental Satellite, Data, and Infor-mation Service, Washington, DC. For primary bibliographic entry see Field 2C. W89-02617

SNOW COVER DATA: STATUS AND FUTURE

PROSPECTS,
Cooperative Inst. for Research in Environmental
Science, Boulder, CO.

Science, Boulder, C.J.
R. G. Barry.
Available from the National Technical Information
Service, Springfield, VA 22161, as DE86-011983.
Price codes: A12 in paper copy; A01 in micrfoiche.
IN: Snow Watch '85. Glaciological Data Report
GD-18. March 1986. p 127-139. 2 fig. 5 tab, 23 ref.
Department of Energy, Carbon Dioxide Research
Division, Contract DE-ACO2-83ER60106.

Descriptors: *Snow cover, *Satellite technology, *Remote sensing, *Meteorological data collection, Climatology, North America, Europe, Cloud

Snow Cover data are collected by a range of national meteorological and hydrological agencies and globally since the mid-1960's by satellite remote sensing. There are major problems of incompatibility between the various types of ground measurement even within a single country. Satellite information has referred only to snow cover extent and is limited by cloudiness and resolution. There is also uncertainty as to what parameter (snow depth, effective integrated short-wave reflectivity, etc.) is of what relevance for climate

studies as compared with hydrological prediction. A survey is given of the status of snow cover data and its availability for North America and European countries. New satellite systems will bring rapid changes and opportunities. The feasibility of snow cover mapping with multifrequency passive microwave radiometer data can be exploited with NASA, NOAA (National Oceanic and Atmospheric Administration) and DMSP (Defense Meterotological Satellite Program) sensors by the late 1980's. In addition, NOAA polar orbiters will carry a 1-5-1.6 micrometer sensor capable of snow-cloud discrimination. Coordinated planning to ensure maximum use of these systems is urgently needed. (See also W89-02606) (Author's abstract) W89-02618

COMPARISON OF NORTHERN HEMI-SPHERE SNOW COVER DATA SETS, Maryland Univ., College Park. Dept. of Meteorol-

For primary bibliographic entry see Field 7C. W89-02619

INFLUENCE OF SNOW STRUCTURE VARIABILITY ON GLOBAL SNOW DEPTH MEASUREMENT USING MICROWAVE RADIO-

METRY, National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center. D. H. Hall.

D. H. Hall.

Available from the National Technical Information
Service, Springfield, VA 22161, as DE86-011983.

Price codes: A12 in paper copy; A01 in micrfoiche.
IN: Snow Watch '85. Glaciological Data Report
GD0-18. March 1986. p 161-171. 3 fig, 1 tab, 16 ref.

Descriptors: *Snow cover, *Snow depth, *Snow-pack, *Radiometry, *Satellite technology, *Remote sensing, *Meteorological data collection, Climatology, Albedo, Depth hoar, Simulation, Model studies, Time series analysis, Microwaves, Alaska, Arctic.

The ability to measure snow depth using microwave radiometry on a global scale depends, in part, upon knowledge of the effects of snow structure on the microwave emission from snow. Even with no increase in snow depth, the microwave emissivity decreases throughout the winter in many snow covered areas. This appears to be related to increasing depth hoar thickness through time. Utilization of a 2-layer radiative transfer model which is used to simulate the microwave emission from a snowpack has enabled a comparison of calculated data points with observations. The observational data consist of a time series of Scanning Multichannel Microwave Radiometer (SMMR) data of the Arctic Coastal Plain of Alaska from January-March 1980. The snowpack is known to develop a depth hoar layer each year as a result of a large temperature gradient in the snowpack which causes crystal sizes at the base of the snowpack to increase through time. Crystals can grow up to 10 mm in size although the average size in the lower or depth hoar layer is considerably less than 10 mm. Using the model, the crystal diameters in the upper and lower layers of the snowpack were set at 0.50 and 1.40 mm respectively. In the first simulation, the depth hoar layer thickness was assumed to be a constant 10 cm with the total snow depth varying as determined from climatological data. When the model results were correlation was R=0.0. For the second simulation, all parameters remained the same as in the correlated with the SMMR data, the coefficient of correlation was R=0.30. For the second simulation, all parameters remained the same as in the first simulation except that the depth hoar layer thickness was increased by 0.50 cm/week to simulate the reported increasing thickness of the depth hoar layer as the winter progresses. In this case, the simulated and observed data points matched quite well with R=0.85. The presence and variability of the depth hoar layer can thus have a significant effect on the microwave emission and the changing snow structure must be considered the changing snow structure must be considered when measuring snow depth using a time series of data. (See also W89-02606) (Author's abstract) W89-02620

RETRIEVAL OF SNOW WATER EQUIVALENT FROM NIMBUS-7 SMMR DATA,

Helsinki Univ. of Technology, Espoo (Finland). Dept. of Electrical Engineering. M. Hallikainen, and P. Jolma.

Available from the National Technical Information Available from the National Technical Information Service, Springfield, VA 22161, as DE86-011983. Price codes: A12 in paper copy; A01 in microfiche. IN: Snow Watch '85. Glaciological Data Report GD-18. March 1986. p 173-179. 5 fig, 4 ref.

Descriptors: *Snow cover, *Satellite technology, *Remote sensing, *Radiometry, *Meteorological data collection, Climatology, Microwaves, Ground

Satellite microwave radiometer data have been used to develop algorithms to retrieve the water equivalent of snow cover both on a global and on a regional basis. Several factors were examined that have an effect on the retrieval accuracy of these algorithms. (1) Snow particle size: measurements and theoretical calculations suggest that, in addition to the water equivalent, the brightness temperature of snow-covered ground depends substantially on the average snow particle size. (2) Snow and ground temperature: due to the low dielectric loss of dry snow, radiometers operating below approximately 20 GHz detect the changes in the temperature of the ground. Since dry snow acts as an efficient thermal insulator, the changes in the temperature of ground surface are small, depending on the thickness of the snow cover. The variation of the brightness temperature is larger than expected the thickness of the snow cover. The variation of the brightness temperature is larger than expected from the variations of the soil temperature alone. This is explained by the dielectric behavior of soils as a function of temperature. (3) Effect of melt-freeze cycles: when the seasonal snow cover starts omelt, days are often warm and nights cold; this causes melt-freeze cycles to occur in the topmost snow layers, resulting in a larger average snow particle size and in a lower brightness temperature at frequencies above 20 GHz. These variations can be interpreted as being due to the start of the melting period. The low brightness temperature due to melt-freeze cycles may erroneously be interpreted as an increase of the water equivalent value. (4) Effect of annual variations: the stratigraphy of seasonal snow cover may vary from winter to (4) Effect of annual variations: the stratigraphy of seasonal snow cover may vary from winter to winter, due to the local weather conditions of each winter. This causes the microwave response to snow water equivalent to vary correspondingly. (5) Effect of land-cover categories: in heavily for-sted areas, the average microwave response to snow water equivalent can be expected to be fairly small, while in open areas (farmlands, etc) the response should be substantially larger. (See also W89.02606) (Sand-PTT)

NIMBUS-7 SMMR SNOW COVER DATA,

National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center. For primary bibliographic entry see Field 7C. W89-02622

SNOW COVER MONITORING USING MICRO-WAVE RADIOMETRY, National Environmental Satellite, Data, and Infor-mation Service, Washington, DC.

N. C. Grody.

Available from the National Technical Inform Available from the National Technical Information Service, Springfield, VA 22161, as DE36-011983. Price codes: A12 in paper copy; A01 in microfiche. IN: Snow Watch '85. Glaciological Data Report GD-18. March 1986, p 189-192. 2 fig. 5 ref.

Descriptors: *Snow cover, *Satellite technology, *Remote sensing, *Meteorological data collection, *Radiometry, Climatology, Microwaves.

Multispectral satellite observations of the earth's surface and atmosphere have provided information on geophysical parameters which are important in meteorology, hydrology, agriculture, and oceanography. The primary advantage of passive microwave measurements over those in the visible and wave measurements over those in the visible and infrared is their ability to probe through clouds, with rain being the major source of attenuation, allowing for all-weather observations. A technique is presented to identify snow cover and discrimi-nate among a number of other surface and atmos-

Group 7B-Data Acquisition

pheric parameters based on measurements by the Nimbus-7 Scanning Multichannel Microwave Ra-diometer. (See also W89-02606) (Author's abstract) W89-02626.

REMOTE SENSING OF SNOW PROPERTIES IN MOUNTAINOUS TERRAIN. California Univ., Santa Barbara. J. Dozier.

J. Dozier.

Available from the National Technical Information Service, Springfield, VA 22161, as DE86-011983. Price codes: A12 in paper copy; A01 in microfiche. IN: Snow Watch '85. Glaciological Data Report GD-18. March 1986. p 193-203. 8 fig, 1 tab, 12 ref.

Descriptors: *Snow cover, *Snow pack, *Satellite technology, *Remote sensing, *Meteorological data collection, *Albedo, Climatology, Mountains.

Spectral albedo measurements from satellite (e.g. Landsat Thematic Mapper) require that spacecraft upwelling radiances be corrected for atmospheric absorption and scattering and for local surface illumination. The lower boundary condition of the atmospheric radiative transfer model varies with incidence angle, and the satellite data must be corgistered to digital elevation data. Results from the statement of the same contractive transfer calculations fall into come simple registered to digital elevation data. Results from extensive transfer calculations fall into some simple statistical relationships, whereby the optical grain size of the snow and the degradation of albedo resulting from contamination are estimated. One remaining problem is that inaccuracies in the elevation data make precise registration with satellite data hard to achieve. (See also W89-02606) (Auabstract)

PARAMETERIZATION OF SNOW ALBEDO FOR CLIMATE MODELS, Colorado Univ. at Boulder. Dept. of Geography. For primary bibliographic entry see Field 7C. W89-02626

METAL SPECIATION: THEORY, ANALYSIS

AND APPLICATION: THEORY, ANAL AND APPLICATION. For primary bibliographic entry see Field 5B. W89-02640

COMBINING FIELD MEASUREMENTS FOR SPECIATION IN NON PERTURBABLE WATER SAMPLES: APPLICATION TO THE IRON AND SULFIDE CYCLES IN A EUTRO-

Geneva Univ. (Switzerland). Dept. of Inorganic, Analytical and Applied Chemistry. For primary bibliographic entry see Field 5B. W89-02645

COMPARISON OF ANODIC STRIPPING VOL-TAMMETRY SPECIATION DATA WITH EM-PIRICAL MODEL PREDICTIONS OF PCU,

North Carolina Univ., Chapel Hill. Dept. of Envi-ronmental Sciences and Engineering. M. S. Shuman.

M. S. Shuman. IIN: Metal Speciation: Theory, Analysis and Application. Lewis Publishers, Chelsea, Michigan. 1988. p. 125-133, 3 fig, 17 ref. National Science Foundation Grant 85-120-69.

Descriptors: *Copper, *Anodic stripping voltammetry, *Trace metals, *Chemical analysis, *Metal complexes, Kinetics, Path of pollutants, Model testing, Comparison studies

When anodic stripping voltammetry is used for metal-organic speciation studies, the measured stripping currents are assumed to reflect the concentration of lable metal in the sample. However, organically-bound metal species can also contribute to stripping currents by dissociating near the electrode surface. An alternative method for technique comparison is based on the use of a calibrative ded empirical model. The model predicts free Cu ion concentration for a wide variety of natural organic material and experimental conditions. Kiorganic material and experimental conditions. Kinetic current corrections on raw anodic stripping voltammetry (ASV) data are shown to be necessary and reasonable to match some data sets to the

model's predictions. Comparison of primary data with predictions of an empirical model such as the one used here is superior to using fitted binding parameters for judging technique differences in speciation studies. Kinetic dissociation accounts for most differences observed between experimental and predicted ASV data and kinetic corrections, although approximate, are useful for judging the influence of kinetic reactions on ASV response. (See also W89-02640) (VerNooy-PTT) W89-02646

MEASUREMENTS OF BINDING SITE CON-CENTRATIONS IN HUMIC SUBSTANCES.

CENTRATIONS IN HUMIC SUBSTÂNCES, Georgia Inst. of Tech., Atlanta. School of Geo-physical Sciences. E. M. Perdue. IN: Metal Speciation: Theory, Analysis and Appli-cation. Lewis Publishers, Chelsea, Michigan. 1988. p 135-154, 11 fig. 1 tab, 26 ref. U.S. EPA Coopera-tive Agreement CR813471-01.

Descriptors: *Decomposing organic *Metal complexes, *Chemical reactions, *Chemical analysis, Trace metals, Thermodynamics, Metals, Measuring instruments, Titration, Model

Humic substances are ubiquitous in the aquatic environment. Their ability to complex metal ions is well documented by many experimental and mod-eling studies and has been the subject of several recent review papers. Some of the experimental and conceptual pitfalls that undermine efforts to quantitatively describe metal-humic complexation in a predictive manner are described, with emphasis on the interpretation of complexation capacity (CC) titration experiments. The use of thermodynamic models to calculate the effect of humic substances on metal speciation requires that the CC substances on metal speciation requires that the CC of the humic substance be determined. It is proposed that the CC of a humic substance is approximately equivalent to its total exchangeable acidity, and that the extent to which this CC can be realized in experimental measurements is strongly a function of pH, ionic strength, nature of the metal being complexed, and the concentration of humic substances used in the measurement. The first three parameters affect conditional concentration questions for the parameters affect conditional concentration questions for the last parameters. parameters affect conditional concentration quo-tients for metal complexation, and the last parame-ter is simply an example of Le Chatelier's Principle in metal-ligand complexation reactions. The results of modeling studies of the effects of pH, ionic strength, and the nature of the complexed metal strength, and the nature of the complexed metal on could be more properly interpreted if the concept of CC as a compositional, rather than thermodynamic, parameter is accepted. (See also W89-02640) (VerNooy-PTT) W89-02647

CHROMATOGRAPHIC APPROACHES TO TRACE ELEMENT SPECIATION, Macdonald Coll., Ste. Anne de Bellevue (Quebec). Dept. of Food Science and Agricultural Chemis-

For primary bibliographic entry see Field 5A. W89-02648

PARTITIONING OF TRACE METALS IN SEDI-

MENTS, Quebec Univ., Sainte-Foy. For primary bibliographic entry see Field 5B. W89-02649

TRACE METAL SPECIATION IN SEDIMENTS AND SOILS; AN OVERVIEW FROM A WATER INDUSTRY PERSPECTIVE, Water Research Centre, Medmenham (England). For primary bibliographic entry see Field 5B. W89-02651

SOIL TESTING AS A GUIDE TO PRUDENT USE OF NITROGEN FERTILIZERS IN OKLAHOMA AGRICULTURE,

Oklahoma State Univ., Stillwater G. V. Johnson.

IN: Ground Water Quality and Agricultural Practices. Lewis Publishers, Chelsea, Michigan. 1987. p

127-135, 3 tab. 4 ref.

Descriptors: *Soil chemistry, *Water pollution control, *Fertilizer, *Nitrogen, *Oklahoma, *Soil tests, Water pollution sources, Groundwater.

Oklahoma farmers and ranchers apply about 570 million pounds of nitrogen to their fields each year as a part of normal crop production practices. Calculations on the amount of nitrogen required by these crops show that more nitrogen is required by the crop plants than is applied as fertilizer. The difference is apparently accounted for by recycled nitrogen contained in the nonharvested portion of the plants and soil organic matter. Oklahoma farmers seem to be using nitrogen fertilizers in a pru-dent manner. An evaluation of the risk of groundwater contamination from fertilizer use is provided by the result of a soil testing campaign. The soil test measures how much nitrate-nitrogen is left test measures now much intrate-introgen is left over from the past cropping season. In 1985, 65 percent of over 17,000 wheat fields tested had less than 15 pounds of nitrate-nitrogen per acre (7.5 ppm) left in the soil. High levels of residual nitrogen are expected whenever crop failures due to weather and/or pests occur. Nitrogen determina-tions from the soil test helps farmers reduce their tions from the son less neigh staticts reduce their fertilizer use to avoid unnecessary carry over from one year to the next. Since unused nitrogen is found by the soil test as nitrate-nitrogen and is more concentrated in the surface soils, the conditions necessary for transporting it to ground water are either absent or very unfavorable. The findings are enture assent or very untavorable. The findings support the conclusion that use of fertilizer nitrogen is appropriate with what is required for current crop production levels. Unused nitrogen accumulates in the surface soil for lack of suitable conditions to transport it to ground water. (See also W89-02654) (Davis-PTT) W89-02664

DJINNANG II: A FACILITY TO STUDY MIXING IN STRATIFIED WATERS,

Western Australia Univ., Nedlands. Dept. of Civil Engineering.

Inberger, and R. Chapman.

IN: Hydrodynamics of Estuaries, Volume II: Estuarine Case Studies. CRC Press, Boca Raton, FL.

1988. p 101-122, 6 fig. 1 tab, 32 ref.

Descriptors: *Measuring instruments, *Mixing, *Stratification, *Estuaries, *Data collections, Computers, Saline water intrusion, Lakes, Coastal regions, Boat.

A flexible data acquisition and data processing system was designed specifically to study mixing in a stratified geophysical flow found in lakes and coastal regions. The in-situ instrumentation includes meteorological stations, mini-loggers, remote profiling station, and portable data acquisition systems. The fine scale profiling equipment includes a portable probe, a fine scale probe, and a mixed layer probe. The Djinnang II is an 8-m, twin-hulled craft chosen for its stability and high speed. The vessel forms the central unit to the four sets of instrumentation: the in-situ equipment. sets of instrumentation; the in-situ equipment, acoustic imaging system, fine scale profilers, and acoustic imaging system, fine scale profilers, and microstructure vehicles can all simultaneously feed their data into the Djinnang II acquisition and computing system. These data were then combined with the boat position, boat speed, orientation of the boat, and depth of the water to form a single data set. The hardware and software have been designed to allow expansion without rendering old data files incompatible. The facility has found application in investigations of mixed layer dynamics, inflows and intrusions in lakes, gravitational overflows in coastal seas, and boundary mixing. (See also W89-02682) (Davis-PTT) also W89-02682) (Davis-PTT) W89-02701

REVIEW OF 183 GHZ MOISTURE PROFILE RETRIEVAL STUDIES,

Atmospheric and Environmental Research, Inc., Cambridge, MA. For primary bibliographic entry see Field 7C. W89-02705

RESOURCES DATA—Field 7

Data Acquisition—Group 7B

APPLICATION OF CS-137 TECHNIQUES TO PROBLEMS OF SEDIMENT REDISTRIBU-TION IN SUNGAI LUI REPRESENTATIVE BASIN, SELANGOR, MALAYSIA: PART I. Unit Tenaga Nuklear, Bangi (Malaysia). For primary bibliographic entry see Field 2J. W89-02712

PRE-FEASIBILITY ON STREAMFLOW GAUGING USING RADIOISOTOPE TRACER METHOD FOR KEMUMBU AGRICULTURE DEVELOPMENT AUTHORITY (KADA), Unit Tenaga Nuklear, Bangi (Malaysia). For primary bibliographic entry see Field 2E. W89-02713

EROSION AND SEDIMENTATION, Exeter Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2J. W89-02723

HYDROLOGY AND DATA ACQUISITION, Oslo Univ. (Norway). Inst. of Geophysics. For primary bibliographic entry see Field 2A. W89-02726

ALKALINITY MEASUREMENTS IN KARST WATER STUDIES, Lancaster Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2F. W89-02729

STABLE ISOTOPES: AN INVESTIGATION INTO THEIR APPLICATION IN KARST HYDROLOGY IN THE U.K., WITH SPECIAL REFERENCE TO THE MALHAM AREA, NORTH

VORKSHIRE, Oxford Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2F. W89-02734

SOCIAL CHOICE AND BENEFIT-COST ANAL-

Middlesex Polytechnic, London (England). Flood Hazard Research Centre.
For primary bibliographic entry see Field 6B.
W89-02756

BIOLOGICAL SURVEYS OF ESTUARIES AND Cambridge University Press, New York. 1987. 449p. Edited by J.M. Baker and W.J. Wolff.

Descriptors: *Surveys, *Estuaries, *Estuarine environment, *Coasts, *Biological surveys, *Seashores, *Aquatic habitats, Planning, On-site investigations, Ecosystems, Project planning, Europe, Data col-

Recent years have seen a growth in demand for biological surveys for a variety of practical purposes, such as environmental impact assessment and surveillance, management of amenity, and identification of sites for conservation priority. Estuaries are defined here as semi-enclosed and coastal bodies of water that have free connections with the open sea and within which sea water is measurably diluted with fresh water derived from land drainage. Coasts are defined as the zone where estuary or sea water meets the land. They include the intertidal zone, nearshore waters and subtidal areas, and cliffs rising directly from the shore. This book aims to give an introduction to techniques (together with their advantages and limitations) for these different habitats and the main groups of organisms to be found in them. The material is mainly European but should be relevant to many organisms to be found in them. The material is mainly European but should be relevant to many parts of the world. This book brings together in one volume techniques for a great diversity of organisms and nabitat that will be useful to those organisms and habitat that will be useru to those planning broadly based surveys, and may also encourage some cross fertilization of methodology between different specializations. (See W89-02760 thru W89-02772) (VerNooy-PTT)

PLANNING BIOLOGICAL SURVEYS, Field Studies Council, Shrewsbury (England). J. M. Barker, J. P. Hartley, and B. Dicks. IN: Biological Surveys of Estuaries and Coasts. Cambridge University Press, New York. 1987. p 1-26, 4 fig. 5 tab, 57 ref.

Descriptors: *Biological surveys, *Data collections, *Project planning, *Surveys, *Estuaries, *Estuarine environment, *Coasts, *Seashores, Onsite investigations, Sampling, Data interpretation, Management planning, Aquatic habitats.

Management planning, Aquatic habitats.

Biological surveys of estuaries and coasts may be carried out for a variety of reasons including scientific research, education, conservation, exploitation of natural resources, management of amenity, environmental impact assessments, biological surveillance or monitoring, contingency plans and damage assessment. It is important to spend sufficient time setting objectives and criteria, and examining options when making decisions. Planning the survey is commonly required on different levels: those of the estuary or coast; the habitat; community or population; and the sample or unit of investigation. Another important dimension is the amount of time required. Data handling and presentation is the last major area of planning. The method of recording data and classification schemes should be determined. Statistical treatment of the results can include variance and standard error, diversity and dominance indices, rarefaction, defining numerically dominant species, multivariate analysis, correlation tests, and estimation of community structure using the log-normal method. Finally, the presentation of the results should also be considered in order to better visualize the outcome. (See also W89-02759) (VerNooy-PTT)

REMOTE SENSING,

REMOTE SENSING, Imperial Coll. of Science and Technology, London (England). Dept. of Pure and Applied Biology. D. H. Dalby, and W. J. Wolff. IN: Biological Surveys of Estuaries and Coasts. Cambridge University Press, New York. 1987. p 27-37, 1 fig. 4 tab. 20 ref.

Descriptors: *Remote sensing, *Surveys, *Aerial photography, *Estuarine environment, *Coasts, *Seashores, *Satellite technology, Surveys, Data acquisition, Data interpretation, Costs, Comparison

Remote sensing techniques are those in which properties of the earth's surface are assessed from a distance, mainly from aircraft of satellites. Two broad categories may be recognized: aerial photog-raphy and digital systems where the information is expressed in digital form directly ready for comexpressed in digital form directly ready for computer processing. Aerial photography is specially suitable for smaller-scale studies with finer ground resolution, while digital remote sensing can be used in surveys for environmental features and conditions such as water depth, suspended sediments in coastal waters, sea surface temperatures and major effluent plumes. False color film can provide a sensitive method for distinguishing between different plant species and vegetation types. The constraints of aerial photography include cost, scale requirements, season, weather and time of day, and state of the tide. Digital systems techniques are based on the transmission of digital data from scanning spectroradiometers recording the intensity of reflected radiation over specific spectral bands. Principles and general information and constraints are discussed, as well as the digital processing of analog imagery. (See also W89-02759) (Ver-Neoy-PTT) Nooy-PTT) W89-02761

SALT MARSHES, Imperial Coll. of Science and Technology, London (England). Dept. of Pure and Applied Biology. D. H. Dalby. IN: Biological Surveys of Estuaries and Coasts. Cambridge University Press, New York. 1987. p 38-80, 3 fig. 1 tab, 106 ref, append.

Descriptors: *Salt marshes, *Tidal marshes, *Surveys, *Coasts, *Seashores, *Sampling, *Mapping,

Ecosystems, Project planning, Planning, Field methods, Wetlands, Aquatic habitats.

methods, Wetlands, Aquatic habitats.

Salt marshes are land areas bordering on the sea, that are covered with vegetation and subject to periodic inundation by the tide. They normally develop along sheltered coasts where fine sediments can accumulate. Salt-marsh survey techniques are as diverse as the marshes themselves are varied. At the start of any survey the limits of the working area will be defined either by the terms of reference or by biological or topographical properties of the site itself. Different types of markers and reference points are discussed, as well as the effects of trampling on the salt marsh. Another important aspect is the preparation of base maps, upon which may be plotted distributions of species, communities, or other items of interest. Photographic cover of small areas, instrument mapping of larger areas, spirit leveling, and tide heights as local datum levels are detailed. Survey base maps may be used for entering the distribution of vegetation units or individual species. Other aspects of surveys include plant abundance, marking individual specienes in the field, and formally classifying salt-marsh communities. Different methods and approaches are discussed in the chapter. Also examined are transect studies, accretion measurements, and sampling salt-marsh fauma. (See also W89-02759) (VerNooy-PTT)

W89-02762

FLORA AND MACROFAUNA OF INTERTI-DAL SEDIMENTS.

Rijksinstituut voor Natuurbeheer, Texel (Nether-

For primary bibliographic entry see Field 2L. W89-02763

MACROFAUNA OF SUBTIDAL SEDIMENTS USING REMOTE SAMPLING.

BP Petroleum Development Ltd., Aberdeen (Scot-

For primary bibliographic entry see Field 2L. W89_02764

PROCESSING SEDIMENT MACROFALINA

BP Petroleum Development Ltd., Aberdeen (Scot-

J. P. Hartley, B. Dicks, and J. Wolff.

IN: Biological Surveys of Estuaries and Coasts. Cambridge University Press, New York. 1987. p 131-139, 1 fig, 25 ref.

Descriptors: *Sampling, *Marine sediments *Benthic fauna, *Surveys, *Biological samples *Coasts, *Sample preparation, Sample preservation, Seashores, Europe.

The processing techniques for macrofauna samples from intertidal and subtidal surveys are outlined in this chapter. Descriptions are given of the extraction of fauna from sediments on board research vessels, on tidal flats, and in the laboratory. The sieve mesh used is undoubtedly one of the most important variables in the processing of benthic samples. The use of a sieve to screen benthic samples places a arbitrary cut-off on the size spectrum of the animals, and reduces their number and the amount of sediment retained. The preservation of unsorted samples is discussed, as well as techniques for sample sorting and analysis. (See also W89-02759) (VerNooy-PIT) W89-02765

MEIOFAUNA, Institute for Soil Fertility, Haren (Netherlands). For primary bibliographic entry see Field 2L. W89-02766

INTERTIDAL ROCK,

Field Studies Council, Shrewsbury (England). For primary bibliographic entry see Field 2L.

Group 7B-Data Acquisition

SUBTIDAL ROCK AND SHALLOW SEDI-MENTS USING DIVING, Field Studies Council, Pembroke (Wales). Oil Pol-

K. Hiscock. In: Biological Surveys of Estuaries and Coasts. Cambridge University Press, New York. 1987. p 198-237, 10 fig, 4 tab, 58 ref.

Descriptors: *Neritic environment, *Underwater, *Scuba diving, *Surveys, *Sampling, Planning, Bottom sampling, Rocks, Sediments, Mapping, Coasts, Seashores, Project planning.

Observations and sampling in sublittoral rocky areas can only be carried out effectively in situ, and free diving (SCUBA) is usually employed. Diving is also used to observe and sample the fauna of sediments where the area is unsuitable for fauna of sediments where the area is unsuitable for remote sampling or where precision is required in the relative positioning of different stations. Techniques are described for survey and sampling on nearshore rock and sediments using diving. Planning the survey, and general equipment and methods are discussed. Also described are methods for in situ surveying of taxa that can be recognized underwater. Types of surveys discussed include presence-absence surveys, semi-quantitative surveys, surveys using photographs, and quantitative surveys and mapping using transects and reference quadrats. Removal of samples for analysis ashore in the laboratory can be used to provide lists of the macrobenthos at a station and accurate counts or macrobenthos at a station and accurate counts or other quantitative measurements of individual spe-cies. Methods for benthic surveys should be tailored to specific requirements. (See also W89-02759) (VerNooy-PTT) W89-02768

BACTERIA AND FUNGI, University Coll. of North Wales, Menai Bridge. School of Ocean Sciences. G. D. Floodgate, and E. B. G. Jones. IN: Biological Surveys of Estuaries and Coasts. Cambridge University Press, New York. 1987. p 238-279, 3 tab, 3 fig, 135 ref.

Descriptors: *Bacterial analysis, *Aquatic fungi, *Fungi, *Surveys, *Sampling, Water sampling, Mi-croscopic analysis, Chemical analysis, Coliforms, Biological samples, Estuarine environment, Coasts.

The ecology of micro-organisms remains the least explored of all the aspects of marine biology. Microbial surveys differ in a number of important ways from surveys of plants and animals. The first task in any bacterial survey is to plan the program and then obtain the sample and process it. Then the process of determining the amount of bacteria process of determining the amount of bacterial numbers must be made. The number of bacterial numbers must be made. The number of bacteria in a given volume can be estimated by either a total count or viable count. Estimation of the amount of bacteria can be made by microscopic or chemical methods, while the activity of bacteria can be determined by autoradiography, changes in the concentration of oxygen, fate of an added substrate or reduction of tetrazolium salts. Processing a sediment sample and growing aguatic bacteria are also ment sample and growing aquatic bacteria are also discussed. The most common bacteriological survey in the marine environment is for coliforms. Besides giving data on water quality, an Escherichia coli survey provides information on the movement of water because the bacteria act as 'tracers' cma con survey provides information on the move-ment of water because the bacteria act as 'tracers.' The main lines of approach to the surveying of fungi are baiting, examination of drift, intertidal and foam samples, direct plating of water and sediments, and examination of living material for parasitic and commercial forms. (See also W89-02759 (VerNooy-PTT) W89-02769 W89-02769

University Coll. of North Wales, Menai Bridge. School of Ocean Sciences. For primary bibliographic entry see Field 2L. W89-02770

FISH (SURVEY OF), Marine Biological Association of the United King-

dom, Plymouth (England). G. W. Potts, and P. J. Reay. IN: Biological Surveys of Estuaries and Coasts. Cambridge University Press, New York. 1987. p 342-373, 4 fig, 1 tab, 143 ref.

Descriptors: *Fish, *Surveys, *Sampling, *Planning, Estuarine environment, Coasts, Seashores, Biological samples, Estuaries.

Many fish are large, long-lived, mobile, and of direct commercial importance. Such characteristics, whether individually or in combination, have a dominant influence on survey techniques. On the other hand, part of every fish community consists of small organisms, whether small species or early life history stages, which can often be surveyed by the techniques used for benthic and planktonic invertebrates. A large range of techniques are available for fish studies. The choice in any particular situation will depend on a variety of factors. For investigating distribution and abundance, the choice will depend on the precise survey objectives, environmental characteristics such as water depth, fish characteristics such as vertical distribudepth, fish characteristics such as vertical distribu-tion, and human resources and the time available. tion, and numan resources and the time available. Equipment and techniques for surveys using observation techniques and those using capture techniques are described. Sample analysis, data processing, and the use of fishery statistics are also detailed. (See also W89-02759) (VerNooy-PTT) W89-02771

BIRDS, Royal Society for the Protection of Birds, Shore-ham-by-Sea (England). For primary bibliographic entry see Field 2L.. W89-02772

ORGANIC CHEMICALS IN NATURAL WATERS: APPLIED MONITORING AND IMPACT ASSESSMENT, Alberta Environmental Centre, Vegreville. For primary bibliographic entry see Field 5C. W89-02776

WATER ANALYSIS: A PRACTICAL GUIDE TO PHYSICO-CHEMICAL, CHEMICAL AND MI-CROBIOLOGICAL WATER EXAMINATION AND QUALITY ASSURANCE,

Springer-Verlag, New York. 1988. 804p.

Descriptors: *Water sampling, *Water analysis, *Water quality, *Bacterial analysis, Chemical analysis, Physical analysis, Biological properties, Water quality control, Measuring instruments, Automa-

The form in water manifests itself is variously The form in water manifests itself is variously modified by its physical properties, its capacity to dissolve solid, liquid and gaseous substances, and by its secondary chemical action and the fact that water provides a habitat for a wide variety of organisms. To be able to use the available water, man must test it, to ascertain whether it can be used for the intended purpose, or whether another source of water must be found. The simplest form of water analysis is local inspection and sensory examination. Modern methods of water analysis employ complex chemical and physico-chemical separation and determination techniques, in which readings are supplied by measuring instruments working on a variety of measuring principles, as well as microbiological techniques. Electronic data processing systems are used to evaluate the results of the analyses. Extensive automation of water analysis and the evaluation of results makes it possible to control water catchment, water treatment, water utilization, sewage treatment and water reclamation. To some extent the simplest test methods, which still have their place in water methods, which still have their place in water analysis today and in many cases are actually indis-pensable, compete with the most modern methods of analysis. The physico-chemical, chemical, radio-chemical, bacteriological and biological analysis procedures compiled in this collection of methods are based on experience, which has shown that it is possible to work from these instructions without having to consult specialized literature. Literature

references are provided to supplement the analytical methods described. (Lantz-PTT) W89-02777

OBSERVATION OF STRATIFORM RAIN WITH 94 GHZ AND S-BAND DOPPLER RADAR,

Rosenstiel School of Marine and Atmospheric Sci-For primary bibliographic entry see Field 2B. W89-02830

SATELLITE RAINFALL RETRIEVAL BY LO-GISTIC REGRESSION, Applied Research Corp., Landoyer, MD. For primary bibliographic entry see Field 7C. W89-02854

FISCAL YEAR 1985 SUMMARY REPORT OF NOAA METEOROLOGY DIVISION SUPPORT TO THE ENVIRONMENTAL PROTECTION AGENCY.

AGENCY.

National Oceanic and Atmospheric Administra-tion, Rockville, MD. Air Resources Labs.

For primary bibliographic entry see Field 5B.

W89-02857

VOLUNTEER LAKE MONITORING PROGRAM, 1987. VOLUME I: STATEWIDE SUMMARY REPORT,

Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control. J. B. Hawes.

J. B. Hawes.
Available from the National Technical Information Service, Springfield, VA. 22161, as PB88-209044.
Price codes: A06 in paper copy, A01 in microfiche.
Report No. IEPA/WPC/88-016a, April 1988.
132p, 8 fig, 7 tab, 6 ref, 5 append.

Descriptors: *Lakes, *Public participation, *Water quality, *Monitoring, *Lakes, *Illinois, Secchi disks, Transparency, Eutrophication, Limnology, Water sampling, Nutrients, Suspended solids.

A Volunteer Lake Monitoring Program initiated by the Illinois EPA in 1981 was continued in 1987. Citizens were trained to measure Secchi disc transparency, total depth, and record field observations from a boat at designated sites on their chosen lake. Readings were to be taken at least twice a month from May through October, and the results forwarded to the Agency. In addition, volunteers for 15 lakes collected water samples for analysis of nutrients and suspended solids when performing the Secchi monitoring. An historical perspective of the Volunteer Lake Monitoring Program is described with program objectives and rationale. Methods for volunteer training and data handling/analysis are described; 1987 program results presented and discussed; and trends analyzed. Two hundred four volunteers participated in monitoring 150 lakes in 1987; 134 lakes had data for 4 or more sampling periods and are included in this report. Average transparencies for the lakes ranged from 7 Average transparencies for the lakes ranged from 7 inches to 167 inches. Two thirds of the 134 lakes monitored 4 or more sampling periods in 1987 had transparencies less than 4 feet; 28% were less than 2 feet. One lake was classified as oligotrophic, thirteen lakes mesotrophic, and the remaining 120 lakes, eutrophic, based on average Secchi disc transparency. (Author's abstract) W89-02869

WATER AND SEDIMENT DYNAMICS OF THE HOMERKA CATCHMENT,

Polish Academy of Sciences, Krakow. Inst. of Geography and Spatial Organization. For primary bibliographic entry see Field 2J. W89-02895

SOURCES OF SEDIMENT AND CHANNEL CHANGES IN SMALL CATCHMENTS OF RO-MANIA'S HILLY REGIONS, Institutul de Geografie, Bucharest (Romania). For primary bibliographic entry see Field 2J.

RESOURCES DATA—Field 7

Data Acquisition—Group 7B

DEVELOPMENT OF FIELD TECHNIQUES FOR ASSESSMENT OF RIVER EROSION AND DEPOSITION IN MID-WALES, UK, Institute of Hydrology, Powys (Wales). For primary bibliographic entry see Field 2J. W89-02898

PRECISE MEASUREMENT OF MICROFORMS AND FABRIC OF ALLUVIAL CONES FOR PREDICTION OF LANDFORM EVOLUTION, Osaka City Univ. (Japan). Dept. of Physics. For primary bibliographic entry see Field 2J. W89-02908

DEVELOPMENT AND FIELD USE OF A SNOW COLLECTOR FOR ACID PRECIPITATION STUDIES, Warren Spring Lab., Stevenage (England). For primary bibliographic entry see Field 5B. W89-02945.

SIMPLIFIED LABORATORY PROCEDURES FOR DO DETERMINATION (APHA/AWWA/ WPCF METHOD),

Lenox Inst. for Research, Inc., MA.
L. K. Wang, E. De Michele, and M. H. Wang.
Available from the National Technical Information
Service, Springfield, VA 22161, as PB88-168067.
Price codes: A03 in paper copy, A01 in microfiche.
Technical Report No. LIR/06-85/142, June 15, 1985

Descriptors: *Water analysis, *Dissolved oxygen, *Monitoring, *Water quality, Wastewater treatment, Model studies, Phenylarsine oxide, Sodium thiosulfate, Standard methods.

The laboratory procedures for dissolved oxygen (DO) Standards Methods for the Examination of Water and Wastewater were simplified by the WPCF Simplified Laboratory Procedures Task Force for use by the waste treatment plant operators. A DO model was introduced for practical application. The EPA recommended phenylarsine oxide (PAO) is also accepted as an alternative to the sodium thiosulfate in DO determination. (Author's abstract) W89-02958

DESIGN OF THE PRIMARY PRE-TRMM AND TRMM GROUND TRUTH SITE, Virginia Univ., Charlottesville. Dept. of Environ-mental Sciences. For primary bibliographic entry see Field 7A. W89-02971

MONITORING AND SURVEILLANCE, National Inst. for Water Research, Pretoria (South

Africa). F. M. Chutter, J. D. Agnew, C. A. Bruwer, and B. K. Fowles. IN: Conservation of South African Rivers. 1986. p

Descriptors: *Data acquisition, *Rivers, *Monitoring, *South Africa, *Surveys, River systems, Lotic environment, Water sampling, Costs, Management

The purpose of the surveillance of lotic systems is the timely detection of ecosystem change beyond the normal range of variability, so that remedial actions may be taken before such change becomes permanent. Remedial action might involve the re-result or elimination of the output of permanent. Remedial action might involve the re-moval or elimination of the cause of change where the whole ecosystem is involved or, perhaps in more desperate circumstances, the removal of an endangered species and its establishment in a less threatened habitat where it was previously un-known. An attempt is made to describe the major components of an ideal surveillance program and relate them to what is usually practically feasible. components of an ideal surveillance program and relate them to what is usually practically feasible. Ideas are offered on matters such as how surveillance should be undertaken; what is involved in the choice of sampling sites and frequency of sampling; the expression of results; who might be responsible for surveillance programs; and what the costs of surveillance programs might be. (See also W89-02985) (Lantz-PTT) W89-02991

ANALYSIS OF BIOMONITORING TECH-NIOUES TO SUPPLEMENT EFFLUENT GUIDELINES.

Energetics, Inc., Columbia, MD. For primary bibliographic entry see Field 5A. W89-02994

ROLE OF TRACER METHODS IN HYDROLOGY AS A SOURCE OF PHYSICAL INFORMATION: BASIC CONCEPTS AND DEFINITIONS, TIME RELATIONSHIP IN DYNAMIC SYS-TEMS.

Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Jacob Blaustein Inst. for Desert Research.

IN: Mathematical Models for Interpretation of Tracer Data in Groundwater Hydrology. Interna-tional Atomic Energy Agency, Vienna, Austria. 1986. p 7-44, 11 fig. 2 tab, 39 ref.

Descriptors: *Groundwater, *Data acquisition, *Tracers, *Systems analysis, *Groundwater move-ment, *Geohydrology, *Literature review, Model studies, Theoretical analysis, Systems analysis, Isotopic tracers, Input-output analysis.

A general review is given of the systems-theory approach to tracer methodology, describing also the relations of the systems theory to other available approaches, such as deterministic mechanism description and stochastic approaches. Methodology and formulation of the systems approach as applied to tracer use in steady-state cases are discussed. Extension of the systems approach for tracer use in non-steady-state cases and input/output relationships for time-varying systems are also given. The material presented is intended to serve as an introduction to basic concepts of tracer theory and methodology that are independent of the specific physical model and mathematical techniques. (See also W89-03009) (Author's abstract) W89-03010

ROLE OF TRACER DATA FOR MODELING SOIL-WATER FLOW IN THE UNSATURATED ZONE,

Heidelberg Univ. (Germany, F.R.). Inst. fuer Umweltphysik. For primary bibliographic entry see Field 2G. W89-03013

APPLICATION OF A TRANSPORT-DIFFU-SION MODEL TO A COASTAL AQUIFER UTI-LIZING IN SITU MEASUREMENTS OF DIS-PERSIVITY,

Istituto di Ricerca sulle Acque, Bari (Italy). For primary bibliographic entry see Field 2F. W89-03016

SURFACE TOPOGRAPHY OF THE LOWER PART OF COLUMBIA GLACIER, ALASKA, 1974-81,

Geological Survey, Tacoma, WA.
For primary bibliographic entry see Field 2C. W89-03021

BED TOPOGRAPHY INFERRED FROM AIR-BORNE RADIO-ECHO SOUNDING OF CO-LUMBIA GLACIER, ALASKA,

Geological Survey, Tacoma, WA. For primary bibliographic entry see Field 2C. W89-03022

NEW SYSTEM OF SEEPAGE SAMPLING FOR THE DETERMINATION OF VOLATILE OR-GANIC SUBSTANCES (NEUES SYSTEM DER SICKERWASSERGEWINNUNG ZUR BESTIM-MUNG LEICHTFLUCHTIGER ORGAN-

MUNG LEICHTFLUCHTIGER ORGAN-ISCHER SPURENSTOFFE), Technische Univ., Munich (Germany, F.R.). Lehr-stuhl fuer Hydrogeologie and Hydrochemie. For primary bibliographic entry see Field 5A. W89-03047

MONITORING BASELINE SUSPENDED SEDI-MENT IN FORESTED BASINS: THE EFFECTS OF SAMPLING ON SUSPENDED SEDIMENT RATING CURVES,

Pacific Southwest Forest and Range Experiment Station, Arcata, CA. For primary bibliographic entry see Field 2J. W89-03053

DETERMINATION OF TRACES OF THALLI-UM IN VARIOUS MATRICES, Commission of the European Communities, Brus-sels (Belgium). Community Bureau of Reference. For primary bibliographic entry see Field 5A. W89-03067

SEISMIC REFRACTION TESTS ABOVE WATER TABLE,
Institut de Mecanique de Grenoble, Saint-Martin d'Heres (France).
For primary bibliographic entry see Field 7A.
W89-03113

INTERPRETATION OF 'CONTROLLED' VS 'NATURAL' EXPERIMENTS IN STREAMS, California Univ., Santa Barbara. Dept. of Biological Sciences

For primary bibliographic entry see Field 7A. W89-03117

NEW BIOLOGICAL MARKER LAYER IN THE SEDIMENTS OF THE GREAT LAKES: BYTH-OTHREPHES CEDERSTROEMI (SCHODLER)

SPINES, National Oceanic and Atmospheric Administra-tion, Ann Arbor, MI. Great Lakes Environmental Research Lab.

For primary bibliographic entry see Field 2H. W89-03178

OPERATIONS FOR AN UNDER-ICE ECOLO-GY PROGRAM,

National Oceanic and Atmospheric Administra-tion, Ann Arbor, MI. Great Lakes Environmental Research Lab.

For primary bibliographic entry see Field 2H. W89-03179

ULTRA-TRACE-LEVEL DETERMINATION OF COBALT, CHROMIUM, AND HYDROGEN PEROXIDE BY LUMINOL CHEMILUMINES-CENCE DETECTED WITH A CHARGE-COU-

CENCE DETECTED WITH A CHARGE-CO-PLED DEVICE, Arizona Univ., Tucson. Dept. of Chemistry. R. D. Jalkian, and M. B. Denton. Applied Spectroscopy APSPA4, Vol. 42, No. 7, p 1194-1199, 1988. 8 fig. 3 tab, 34 ref.

Descriptors: *Cobalt, *Chromium, *Heavy metals, *Peroxides, *Trace levels, *Spectroscopy, Pollutation identification, Chemical analysis, Chemiluminescence, Luminol, Optical properties.

A solid-state two-dimensional charge-coupled device (CCD) is used to detect the chemiluminescence of luminol with hydrogen peroxide and a transition metal ion. The chemiluminescence spectra are recorded with the use of trace amounts of metal ions. Excellent linearity, dynamic range, and detections limits are obtained for the total amount of Cr(+++), Co(++), and H2O2 analyzed by manual injection. Detection limits on the order of low femto-mole levels of analytes are reported. The utility of CCDs for ultra-low-level light measurements is discussed, and new concepts for 'luminometers,' both wavelength dispersive and non-dispersive, are described. (Author's abstract) W89-03181

CONTINUOUS FLOW DETERMINATION OF CARBON DIOXIDE IN WATER BY MEMBRANE SEPARATION-CHEMILUMINESCENT

Osaka Prefectural Univ., Sakai (Japan). Lab. of Environmental Chemistry

Group 7B-Data Acquisition

T. Aoki, K. Ito, and M. Munemori. Analytical Letters ANALBP, Vol. 21, No. 10, p 1881-1886, October 1988. 4 fig, 1 tab, 8 ref.

Descriptors: *Carbon dioxide. *Chemical analysis. Separation techniques, Spectroscopy, *Chemiluminescence, Luminol, Continuous flow, Pollutant identification, Membrane filters.

Carbon dioxide has been found to enhance the chemiluminescence of a luminol system. A deter-mination method for carbon dioxide in water was mination method for carbon dioxide in water was developed by applying this reaction to a continuous flow membrane-separation system. Concentrations of carbon dioxide as low as 0.04 micrograms C/mL were determined. Membrane-separation effectively eliminates interferences from Co(II), Cr(III), Fe(III), and other ions which also enhance chemiluminescence. The relative standard deviation for this method was 2.8% (n=5) for 4.0 micrograms C/mL and the time required for the analysis of one sample was 3.0 min. Studies on the continuous determination of total organic carbon in natural waters using the present method are now being carried out in detail, and the results will be published later. (Author's abstract) W89-03182

XANTHENE DYE CHEMILUMINESCENCE FOR DETERMINATION OF FREE CHLORINE IN WATER,

Tokyo Metropolitan Univ. (Japan). Dept. of Indus-

Trial Chemistry.

M. Yamada, T. Hobo, and S. Suzuki.
Analytical Letters ANALBP, Vol. 21, No. 10, p
1887-1900, October 1988. 3 fig, 4 tab, 16 ref.

Descriptors: *Chemical analysis, *Dyes, *Chlorine, *Spectroscopy, Chemiluminescence, Drinking water, Xanthene dyes, Optical properties.

reliminary investigations by a batch method are described for aiming at the flow determination of free chlorine in water with novel chemiluminescence (CLS) detection. The CLS originates from the reaction of xanthene dyes with free chlorine, Cl2, HOCl, and OCl(-). Through the measurements of CLS decay curves, fundamental CLS characteristics were explored from the analytical point of view. Among xanthene dyes tested, cosin Y, eosin B, pyronin B, and rhodamine 6G were found to be promising CLS reagents with such sensitivity and selectivity that free chlorine can be readily determined in tap water. In particular, these CL systems have the special advantage of being insensitive to oxo acids or chlorine and chloramine. Recommended flow systems are proposed. (Author's abstract)

SEDIMENT TRANSPORT PREDICTION IN A TIDAL INLET USING A NUMERICAL MODEL: APPLICATION TO STONY BROOK HARBOR, LONG ISLAND, NEW YORK, USA, State Univ. of New York at Stony Brook. Marine Sciences Research Center.

For primary bibliographic entry see Field 2J. W89-03185

MODIFICATION AND ASSESSMENT OF AN INDEX OF BIOTIC INTEGRITY TO QUANTIFY STREAM QUALITY IN SOUTHERN ON-

Toronto Univ. (Ontario). Dept. of Zoology. For primary bibliographic entry see Field 4C.

COMPARISON OF IN SITU ESTIMATES OF CHLOROPHYLL A OBTAINED WITH WHAT-MAN GF/F AND GF/C GLASS-FIBER FILTERS IN MESOTROPHIC TO HYPEREUTOPHIC IN ME

LAKES, Alberta Univ., Edmonton. Dept. of Zoology. E. E. Prepas, M. E. Dunnigan, and A. M. Trimbee. Canadian Journal of Fisheries and Aquatic Sci-ences CJFSDX, Vol. 45, No. 5, p 910-914, May 1988. 1 fig, 1 tab, 30 ref.

Descriptors: *Chlorophyll a, *Limnology, *Water analysis, *Lakes, *Water sampling, Filter paper, Aquatic plants, Comparison studies.

In response to the recent attention given to pico-plankton, many researchers have switched from GF/C to GF/F glass-fiber filters for chlorophyll a (Chl a) analyses; GF/F filters have a smaller pore size and are more expensive than GF/C filters. Chl a was measured with both Whatman GF/F and GF/C glass-fiber filters on euphotic zone water from 28 mesotrophic to hypereutrophic lakes (Chl a ranged from 2 to 175 micrograms/L) in central Alberta. The differences between paired Chl a estimates with the two grades of filter paper were remarkably small; there was no evidence that GF/ F filters collected more Chl a than GF/C filters (P 9 0.2). Hence there is no justification for switch-> 0.2). Hence there is no justification for switching from GF/C to GF/F filters for routine Chl a analyses on productive lakes. (Author's abstract)
W89-03217

INTERRELATIONSHIP BETWEEN IN VIVO FLUORESCENCE OF PHYTOPLANKTON AND LIGHT BEAM TRANSMISSION WITH REFERENCE TO FLUORESCENCE YIELD, Laval Univ., Quebec. Dept. de Biologie. For primary bibliographic entry see Field 2L. W89-03233

MEASURING WATER CLARITY WITH A

MEASURING WATER CLARITY WITH A BLACK DISK, Ministry of Works and Development, Hamilton (New Zealand). Water Quality Centre. R. J. Davies-Colley. Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 1, p 616-623, July 1988. 4 fig. 2 tab, 1

Descriptors: *Secchi disks, *Optical properties, *Turbidity, Lakes, Opacity, *Rivers, Black disk.

A technique using black 'Secchi' disks of 200 and 100 mm diameter in eight lakes and eleven rivers of diverse optical character was devised. The black disk method for assessing visual water clarity conforms to the theory of visibility for large, dark objects. The black disk seems unlikely to supplant the Secchi disk for assessing clarity of lake waters, if only because of the need for continuity of existing data sets. The black disk has significant practical as well as theoretical advantages for measuring water clarity, however, particularly in river where deployment of the Secchi disk is difficult. (Miller-PTT) W89-03251

HIGH-PRECISION RESPIROMETER FOR MEASURING SMALL RATES OF CHANGE IN THE OXYGEN CONCENTRATION OF NATU-RAL WATERS,

Georgia Univ., Athens. Inst. of Ecology P. C. Griffith.

Limnology and Oceanography LIOCAH, Vol. 33, No. 4, Part 1, p 632-638, July 1988. 4 fig, 20 ref. DOE Grant DE-FG09-86ER60451.

Descriptors: *Respirometers, *Respiror *Respiration, *Plankton, *Oxygen, Georgia. *Respirometry.

A computer-controlled system is described that A computer-controlled system is described that can detect very low respiration rates of planktonic organisms in unconcentrated samples of ocean water. The polarographic sensor used consumed < 0.0001 microM O2/h and thus required little stirring. Estimates of community respiration of -2.23 + or -0.06 and -0.19 + or -0.04 microM O2/h were made during short-term incubations of the waters of the middle and outer continental shelf of Georgia. (Author's abstract) W89-03252

OKLAHOMA-KANSAS MESOSCALE CONVECTIVE SYSTEM OF 10-11 JUNE 1985; PRECIPITATION STRUCTURE AND SINGLE-DOPP LER RADAR ANALYSIS, Oregon State Univ., Corvallis. Dept. of Atmos-

pheric Sciences.
For primary bibliographic entry see Field 2B.

W89-03273

USE OF REMOTE GAUGING TO MEASURE SEWER INVERT ELEVATIONS AND HEAD LOSS,

RJN Environmental Associates, Inc., College Park, MD.

For primary bibliographic entry see Field 5D. W89-03280

CAPILLARY GAS CHROMATOGRAPHIC DE-TERMINATION OF AMITROLE IN WATER WITH ALKALI FLAME IONIZATION DETEC-

Centraal Inst. voor Voedingsonderzoek TNO, Zeist (Netherlands). Toxicological Analysis Dept. For primary bibliographic entry see Field 5A.

PREDICTION OF RESERVOIR PHYTO-PLANKTON CONDITION BY THE FLUORES-CENCE METHOD,

Institute of Biophysics, Krasnoyarsk (USSR). For primary bibliographic entry see Field 2H. W89-03291

PROBABILITY DISTRIBUTION FOR CRITI-CAL DO LOCATION IN STREAMS,

Wyoming Water Research Center, Laramie. Y.-K. Tung, and W. E. Hathhorn. Ecological Modelling ECMODT, Vol. 42, No. 1, p 45-60, July 1988. 1 fig. 6 tab, 27 ref.

Descriptors: *Streams, *Probability distribution, *Statistical analysis, *Water quality forecasting, *Dissolved oxygen, Water quality, Critical loca-tion, Oxygen deficit.

The critical location Xc (in miles) in a stream environment is defined as the point of maximum dissolved oxygen deficit within any reach of stream. The appropriateness of using some of the more common probability distributions (along with a nonparametric Fisher-Cornish asymptotic expansion) to describe the reaches describe the stream of the property of the propert a nonparametric Fisher-Cornish asymptotic expan-sion) to describe the random characteristics of the critical location in a stochastic stream environ-ment, based on the statistical moments of Xc esti-mated using first order analysis, is assessed. Prelim-inary results of this study, based on three curve fitting criteria, show that the two-parameter gamma distribution best describes the unknown character of the critical location in the majority of the cases examined. It is cautioned that the gamma the cases examined. It is cautioned that the gamma distribution found in this study for best describing the distribution of Xc may not be entirely valid if different water quality parameters are considered. (Miller-PTT) W89-03292

ANALYSIS OF VOLATILE HALOGENATED HYDROCARBONS ON THE PPQ SCALE,

Innsbruck Univ. (Austria). Inst. fuer Radiochemie und Angewandte Physikalische Chemie. For primary bibliographic entry see Field 5A. W89-03301

COMPARATIVE STUDY OF DIFFERENT TECHNIQUES FOR NITRATE DETERMINATION IN ENVIRONMENTAL WATER SAM-

Thessaloniki Univ., Salonika (Greece). Environmental Pollution Control Lab. For primary bibliographic entry see Field 5A.

DIAGNOSTIC TECHNIQUE FOR TARGETING DURING AIRBORNE SEEDING EXPERIMENTS IN WINTERTIME STORMS OVER THE SIERRA NEVADA,

Electronic Techniques, Inc., Fort Collins, CO. For primary bibliographic entry see Field 2B.

Evaluation, Processing and Publication—Group 7C

ESTIMATE OF PRECIPITATION ENHANCE-MENT POTENTIAL FOR THE DUERO BASIN OF SPAIN

Wyoming Univ., Laramie. Dept. of Atmospheric Science.

For primary bibliographic entry see Field 3B. W89-03306

NIMBUS-7 GLOBAL CLOUD CLIMATOLOGY: PART 1. ALGORITHMS AND VALIDATION, National Environmental Satellite, Data, and Infor-mation Service, Washington, DC. For primary bibliographic entry see Field 2B. W89-03307

COMPARISON OF FLOW-THROUGH AND TOWED FLUOROMETERS FOR MEASURING OIL CONCENTRATIONS IN THE SEA, Warren Spring Lab., Stevenage (England). For primary bibliographic entry see Field 5A. W89-03329

RATIONALE FOR THE DESIGN OF MONITORING WELL SCREENS AND FILTER

TORING WELL SCREENS AND FILTER PACKS,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5B.
W89-03332

7C. Evaluation, Processing and Publication

ESTUARINE INVERTEBRATES AND FISH: SAMPLING DESIGN AND CONSTRAINTS FOR LONG-TERM MEASUREMENTS OF POPULATION DYNAMICS, Smithsonian Environmental Research Center, Edgewater, MD. For primary bibliographic entry see Field 2L. W89-02327

DEVELOPMENT, MANAGEMENT, AND ANALYSIS OF A LONG-TERM ECOLOGICAL RESEARCH INFORMATION BASE: EXAMPLE FOR MARINE MACROBENTHOS, South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research. For primary bibliographic entry see Field 10D. W89-02329

MONITORING AND QUALITY ASSURANCE PROCEDURES FOR THE STUDY OF REMOTE WATERSHED ECOSYSTEMS, Michigan Technological Univ., Houghton. Dept. of Biological Sciences. For primary bibliographic entry see Field 5A. W89-02330

TRANSITION FROM GROUND-WATER MINING TO INDUCED RECHARGE IN GEN-ERALIZED HYDROGEOLOGIC SYSTEMS, Leggette, Brashears and Graham, Inc., Albuquer-

que, NM.
For primary bibliographic entry see Field 4B.
W89-02337

SIMULATING UNDERGROUND MINES IN A REGIONAL MODEL, Schreuder and Davis, Inc., Tampa, FL For primary bibliographic entry see Field 4C. W89-02339

MODELING THE RESPONSE OF LAKE-AQUI-FER SYSTEMS TO ACID PRECIPITATION, New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.
For primary bibliographic entry see Field 5C.

MODELING OF POLYCHLORINATED BI-PHENYLS IN VADOSE ZONE, Weston (Roy F.), Inc., West Chester, PA.

For primary bibliographic entry see Field 5B. W89-02353

INTERNATIONAL LEGEND FOR HYDRO-GEOLOGICAL MAPS: PRINCIPLES AND AP-

PLICATION, Bundesanstalt fuer Geowissenschaften und Roh-Bundesanstalt fuer Geowissenschaften und stoffe, Hanover (Germany, F.R.). For primary bibliographic entry see Field 7B. W89-02386

NUMERICAL MODEL FOR THE COMPUTA-TION OF RADIANCE DISTRIBUTIONS IN NATURAL WATERS WITH WIND-ROUGH-ENED SURFACES, PART II: USER'S GUIDE AND CODE LISTING, Joint Inst. for the Study of the Atmosphere and Ocean, Seattle, WA. For primary bibliographic entry see Field 2H. W89-02414

EXTERNAL QUALITY-ASSURANCE RESULTS FOR THE NATIONAL ATMOSPHERIC DEPO-SITION PROGRAM AND NATIONAL TRENDS NETWORK DURING 1986,

Geological Survey, Denver, CO. Water Resources

R. B. See, L. J. Schroder, and T. C. Willoughby. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 88-4007, 1988. 15p, 8 tab, 18 ref.

Descriptors: *Quality assurance, *Water analysis, *Chemical analysis, *Acid rain, Laboratories, Rainfall, Chemistry of precipitation, Precipitation.

During 1986, the U.S. Geological Survey three programs to provide external quality-assurance monitoring of the National Atmospheric Deposition Program and National Trends Network. ance monitoring of the National Atmospheric Deposition Program and National Trends Network. An intersite-comparison program was used to assess the accuracy of onsite pH and specific-conductance determinations at quarterly intervals. The blind-audit program was used to assess the effect of routine sample handling on the precision and bias of program and network wet-deposition data. Analytical results from four laboratories, which routinely analyze wet-deposition samples, were examined to determine if differences existed between laboratory analytical precision of each laboratory. An average of 78 and 89 percent of the site operators participating in the intersite-comparison met the network goals for pH and specific conductance. A comparison of analytical values were slightly but significantly (a = 0.01) targer than actual values for pH, magnesium, sodium, and sulfate; analytical values for specific conductance were slightly less than actual values. The decreased precision in the analyses of blind-audit program indicated that analytical values for specific conductance were slightly less than actual values than actual values for pH, magnesium, sodium, and sulfate; analytical values for specific conductance were slightly less than actual values the decreased precision in the analyses of blind-audit programs indicates that a large amount of uncertainty in network deposition data may be a result of routine field operations. The results of the interlaboratory comparison study indicated that the magnitude of the difference between laboratory analyses was small for all analytes. Analyses of deionized, distilled water blanks by participating laboratories indiciated that the laboratories had difficulty ized, distilled water blanks by participating labora-tories indicated that the laboratories had difficulty measuring analyte concentrations near their reported detection limits. (USGS) W89-02463

SELECTED LITERATURE ON WATER RE-SOURCES INVESTIGATIONS IN NEW JERSEY BY THE U.S. GEOLOGICAL SURVEY, THROUGH 1986,

Geological Survey, Trenton, NJ. Water Resources

For primary bibliographic entry see Field 10C. W89-02466

WATER RESOURCES PUBLICATIONS OF THE U.S. GEOLOGICAL SURVEY, FOR TEN-NESSEE, 1906-1987, Geological Survey, Nashville, TN. Water Re-

For primary bibliographic entry see Field 10C. W89-02467

GROUNDWATER LEVELS IN WYOMING, 1978 THROUGH SEPTEMBER 1987, Geological Survey, Cheyenne, WY. Water Re-For primary bibliographic entry see Field 4B. W89-02468 sources Div.

WATER RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN MISSOURI, FISCAL YEAR 1987,
Geological Survey, Rolla, MO. Water Resources

For primary bibliographic entry see Field 9C. W89-02470

PROCEEDINGS, SEVENTEENTH MISSISSIP-PI WATER RESOURCES CONFERENCE, 25-26 MARCH, 1987, JACKSON, MISSISSIPPI. Mississippi State Univ., Mississippi State. Water Resources Research Inst. For primary bibliographic entry see Field 6B. W89-02476

COMPARISON OF CONCEPTUALLY BASED AND REGRESSION RAINFALL-RUNOFF MODELS, DENVER METROPOLITAN AREA, COLORADO, AND POTENTIAL APPLICATIONS IN URBAN AREAS, Geological Survey, Denver, CO. Water Resources

For primary bibliographic entry see Field 4C. W89-02483

ASSESSMENT OF WATER QUALITY AND FACTORS AFFECTING DISSOLVED OXYGEN IN THE SANGAMON RIVER, DECATUR TO RIVERTON, ILLINOIS, SUMMER 1982, Geological Survey, Urbana, IL. Water Resources Div.

For primary bibliographic entry see Field 5B. W89-02486

WATER RESOURCES OF WALWORTH COUNTY, SOUTH DAKOTA, Geological Survey, Huron, SD. Water Resources

For primary bibliographic entry see Field 2F. W89-02489

GROUNDWATER RESOURCES OF RUSK COUNTY, TEXAS, Geological Survey, Austin, TX. Water Resources

For primary bibliographic entry see Field 2F.

W89-02491

STATISTICAL ANALYSES OF FLOOD FRE-QUENCY, LOW-FLOW FREQUENCY AND FLOW DURATION OF STREAMS IN THE PHILADELPHIA AREA, PENNSYLVANIA, Geological Survey, Harrisburg, PA. Water Re-

For primary bibliographic entry see Field 2E. W89-02492

HISTORY OF ANNUAL STREAMFLOWS FROM THE 21 WATER RESOURCES RE-GIONS IN THE UNITED STATES AND PUERTO RICO, 1951-83, Geological Survey, Madison, WI. Water Re-

D. J. Graczyk, W. R. Krug, and W. A. Gebert. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-128, 1986. 30p, 9 fig, 25 tab, 3 ref.

Descriptors: *United States, *Puerto Rico, *Runoff, *Gaging stations, *Streamflow, Annual runoff, Data collections.

Group 7C-Evaluation, Processing and Publication

Annual streamflows from the 21 water resources regions in the United States and Puerto Rico were calculated for the period 1951-83. The total streamflow discharging to the oceans from the conterminous United States during this period averaged, 1,270 billion gallons per day. The outflow from the Lower Mississippi Water Resources Region (08), which drains 41 percent of the land area of the conterminous United States, contributes 34 percent of the total streamflow to the oceans, which is the most of any region. (USGS)

DISCHARGE RATINGS FOR CONTROL STRUCTURES AT MCHENRY DAM ON THE FOX RIVER, ILLINOIS, Geological Survey, De Kalb, IL. Water Resources

For primary bibliographic entry see Field 7B. W89-02494

GROUNDWATER DATA FOR MICHIGAN-

1986, Geological Survey, Lansing, MI. Water Resources

Div. G. C. Huffman

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 88-87, 1988. 52p, 5 fig, 3 tab, 115 ref.

Descriptors: *Groundwater, *Hydrologic data, *Groundwater hydrographs, *Michigan, Water levels, Water use, Water quality, Data collections.

Water levels, location, depths, and aquifers tapped are given for 112 observation wells in Michigan for 1986. Tabulated data include extremes of water levels for 1986 and for the period of record, pumpage of most major groundwater users in the State, and water quality data from selected wells. (USGS) W89-02495

RECORDS OF WELLS, DRILLERS' LOGS, WATER LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUNDWATER IN HARRIS AND GALVESTON COUNTIES, TEXAS 1980-84

Geological Survey, Houston, TX. Water Resources Div

sources Div. J. F. Williams, L. S. Coplin, C. E. Ranzau, W. B. Lind, and C. W. Bonnet. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-38, 1987. 245p, 2 fig, 8 tab, 11 ref.

Descriptors: *Groundwater data, *Subsidence, *Drillers logs, *Water levels, *Chemical analyses, *Texas, Groundwater.

Information on major new water wells in Harris and Galveston Counties, Texas, was compiled by the U.S. Geological Survey from 1980 to 1984. This report presents the results of the hydrologic data collection on new large-capacity and other selected wells, including well location and completion data, driller's logs of the strata penetrated, water levels, and chemical quality of the produced water. These water-well data are supplementary to similar data on older wells in these counties and to descriptive evaluations of the groundwater resources which have been published previously. (USGS) (USGS) W89-02497

HYDROLOGIC AND GEOLOGIC DATA FOR THE EDWARDS AQUIFER RECHARGE ZONE NEAR GEORGETOWN, WILLIAMSON NEAR GEORGETOWN, WILLIAMSON COUNTY, TEXAS, 1986-87, Geological Survey, Austin, TX. Water Resources

For primary bibliographic entry see Field 2F. W89-02499

METHOD FOR DELINEATING FLOOD-PRONE AREAS IN THE GREAT BASIN OF NEVADA AND ADJACENT STATES, Geological Survey, Carson City, NV. Water Re-

For primary bibliographic entry see Field 2E. W89-02500

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT AND VICINITY, FLORIDA, SEPTEMBER 1987, Geological Survey, Orlando, FL. Water Resources Discourage of the property of the

L. A. Bradner.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-688, 1987.

Descriptors: *Maps, *Potentiometric surface, *Groundwater, *Geohydrology, *Florida, *Floridan aquifer, Hydrologic aspects, Aquifers, St. Johns River.

This map shows the potentiometric surface of the Upper Floridan aquifer in the St. Johns River Water Management District and vicinity for September 1987. The Upper Floridan aquifer is the principal source of potable water in the area. Water level measurements were made on approximately 1000 well-red on expend sories. mately 1,000 wells and on several springs. The potentiometric surface is shown mostly by 5-foot potentiometric surface is shown mostly by 5-foot contour intervals. The potentiometric surface ranged from 129 feet above sea level in Polk County to 77 feet below sea level in Nassau County. Water levels in most key wells ranged from 0 to 10 feet below in May 1987 levels in response to the lack of recharge from rainfall and an attendant increase in pumpage. Declines of about 0 to 3 feet from May 1987 levels were common in most areas of the district. However, the largest declines from May 1987 levels, as much a 7 to 10 feet, were mostly in well fields along the coastline. Many levels in the district were equal to or lower than the average levels of September 1986. (USGS) 1986. (USGS) W89-02503

DOCUMENTATION FOR A DIGITAL COM-PUTER MODEL OF NUTRIENT AND DIS-SOLVED-OXYGEN TRANSPORT IN THE TRUCKEE RIVER AND TRUCKEE CANAL DOWNSTREAM FROM RENO, NEVADA, Geological Survey, Carson City, NV. Water Re-sources Div.

For primary bibliographic entry see Field 5B. W89-02504

RECORDS OF WELLS AND CHEMICAL ANALYSES OF GROUNDWATER IN HAND AND HYDE COUNTIES SOUTH DAKOTA, Geological Survey, Huron, SD. Water Resources

Div. For primary bibliographic entry see Field 2F. W89-02505

DATA ON THE DISTRIBUTION AND ABUNDANCE OF SUBMERSED AQUATIC VEGETATION IN THE TIDAL POTOMAC RIVER AND ESTUARY, MARYLAND, VIRGINIA, AND THE DISTRICT OF COLUMBIA, 1986, Geological Survey, Reston, VA. Water Resources

N. B. Rybicki, R. T. Anderson, J. M. Shapiro, K. L. Johnson, and C. L. Schulman. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-575, 1987. 82p, 6 fig, 36 tab, 17 ref.

Descriptors: *Submersed aquatic vegetation, *Water quality, *Submerged plants, *Aquatic plants, Biomass, Macrophytes, Potomac River, Maryland, Virginia, Washington D.C., District of

This report summarizes data on the distribution and abundance of submersed aquatic vegetation collected in the tidal Potomac River and Estuary during 1986. Plant species were identified and dry weight determined for selected sites sampled in spring and fall. The percentage of each plant spe-cies was determined in areas of high plant density

in the fall. Water quality characteristics measured in the fall. Water quality characteristics measured include temperature, specific conductance, dissolved oxygen, pH, and transparency as indicated by Secchi depth. Maps were made of the distribution of submersed aquatic vegetation based on transect samples and a complete shoreline survey. (USGS)

DRAINAGE AREAS IN THE JAMES RIVER BASIN IN EASTERN SOUTH DAKOTA.

Geological Survey, Huron, SD. Water Resources

R. D. Benson, M. E. Freese, F. D. Amundson, and V. J. Wipf.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Map Report 87-572, 1987. 1 sheet (map), 1 fig.

Descriptors: *Surface water, *Drainage areas, *South Dakota, *James River Basin, *Maps.

The James River of eastern South Dakota contain The James River of eastern South Dakota contains an important surface-water supply for the agricultural economy within the basin. Proposed water-resource development has prompted numerous hydrologic studies of the James River. To aid in planning for future development, the map delineates all named stream basins, and all unnamed basins larger than 10 square miles within the James River basin South Dakota and lists by stream name and area of each basin. Stream drainage basins were delineated by visual interpretation of contour and area or each basin. Stream drainage basins were delineated by visual interpretation of contour information of U.S. Geological Survey seven and one-half minute topographic maps. Two tables list areas of drainage basins, reaches, and noncontributing areas and drainage areas above gaging stations. (USGS) W89-02515

GROUNDWATER FLOW IN THE NAVAJO SANDSTONE IN PARTS OF EMERY, GRAND, CARBON, WAYNE, GARFIELD, AND KANE COUNTIES, SOUTHEAST UTAH,

Geological Survey, Lakewood, CO. Water Resources Div.

For primary bibliographic entry see Field 2F. W89-02521

GROUNDWATER LEVELS IN THE ALLUVIAL AQUIFER IN EASTERN ARKANSAS, 1986, Geological Survey, Little Rock, AR. Water Re-For primary bibliographic entry see Field 2F. W89-02522 sources Div.

GROUNDWATER LEVELS IN WYOMING, 1976 THROUGH 1985,

Geological Survey, Cheyenne, WY. Water Resources Div

H. I. Kennedy, and C. B. Oberender.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-456, 1987. 122p, 16 fig, 9 ref.

Descriptors: *Hydrographs, *Groundwater, *Observation wells, *Wyoming, *Hydrologic data, Water level recorders.

Groundwater levels are measured periodically in a network of 84 observation wells in Wyoming, mostly in areas where groundwater is used in large quantities for irrigation or municipal purposes. The program is conducted by the U.S. Geological Survey in cooperation with the Wyoming State Engineer and the Wyoming Economic Development and Stabilization Board. This report contains hydrographs for 84 observation wells showing water-level fluctuations from 1976 through 1985. Also included in the report are maps showing locations of observation wells and tables listing well depths, use of water, geologic source, records available, and highest and lowest water levels for the period of record. (USGS) W89-02525

Evaluation, Processing and Publication—Group 7C

MAP SHOWING GROUNDWATER LEVELS IN ANCHORAGE, ALASKA, 1985, Geological Survey, Anchorage, AK. Water Re-

sources Div R. L. Glass.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report (map report) 87-546, 1987. 2 sheets, 21 fig, 2 tab, 6 ref.

Descriptors: *Water levels, *Maps, *Hydrographs, *Observation wells, *Alaska, Aquifers, Groundwater conditions, Well data, Anchorage.

Water-level data collected during 1985 for 146 Anchorage wells deeper than 40 feet are presented. Hydrographs of water levels in 20 wells for the period 1970 through 1985 are also given. The report describes groundwater conditions and sea-sonal fluctuations in water levels, and includes pumpage figures and well-construction data. pumpage (USGS) W89-02526

SELECTED WATER-QUALITY DATA FOR THE MURTAUGH LAKE AREA, SOUTH CEN-TRAL IDAHO, JUNE 1987, Geological Survey, Boise, ID. Water Resources

Div.
D. J. Parliman, and H. W. Young.
Available from OFSS, USGS, Box 25425, Denver,
CO 80225. USGS Open-File Report (map) 87-466,
1987. 1 sheet, 3 fig, 2 tab, 2 ref.

Descriptors: *Maps, *Water quality, *Nitrogen compounds, *Groundwater pollution, *Chlorides, *Groundwater contamination, Drinking water, Groundwater level, Nitrate, Idaho, Snake River, Plain, Murtaugh Lake.

This report presents June 1987 water-quality data, principally dissolved chloride and dissolved nitrite plus nitrate (as nitrogen), for water samples from 45 wells in the Murtaugh Lake area, south-central Idaho. Chloride concentrations ranged from 23 to Idaho. Chloride concentrations ranged from 23 to 320 milligrams per liter; the median concentration was 70 milligrams per liter. Nitrogen concentrations ranged from less than 0.1 to 11.0 milligrams per liter; the median concentration was 3.7 milligrams per liter. Chloride concentrations in 6 samples and nitrogen concentrations in 3 samples equaled or exceeded the U.S. Environmental Protection Agency while drinking-user limits of 700 millions of the protection of the protectio tection Agency public drinking-water limits of 250 and 10 milligrams per liter, respectively. (USGS) W89-02530

SELECTED HYDROGEOLOGIC DATA FOR THE SOUTHWEST GLENDIVE PRELIMI-NARY LOGICAL MINING UNIT AND ADJA-CENT AREAS, DAWSON COUNTY, MON-

Geological Survey, Honolulu, HI. Water Re-R. S. Roberts.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-390, 1987. 34p, 9 fig, 5 tab, 10 ref.

Descriptors: *Data collections, *Hydrologic data, *Montana, *Geohydrology, Dawson County.

Hydrogeologic data were collected from a coal area in Dawson County, Montana, to provide a basis for identifying and characterizing the groundwater resources. Inventory records for 72 domestic, stock, irrigation, unused, and observation wells are tabulated in the report; the data were collected principally from 1977 through 1981. The location of each well is shown on a map. Natural-gamma geophysical logs, and water level measurements are also included for selection wells. Twenty-six analyses of groundwater identify the chemical-constituent concentrations and physical properties of water from sampled wells. (USGS) Hydrogeologic data were collected from a coal

POTENTIOMETRIC SURFACE OF THE IN-TERMEDIATE AQUIFER SYSTEM, WEST-CENTRAL FLORIDA, SEPTEMBER 1986, Geological Survey, Tampa, FL. Water Resources

B. R. Lewelling. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-35, 1987. 1 sheet (map), 4 fig, 2 ref.

Descriptors: *Potentiometric surface, *Hydrogeology, *Florida, Groundwater flow, Hydrology, Data collections, Hydrologic data.

A September 1986 potentiometric-surface map of the intermediate aquifer system in west-central Florida depicts water levels for the annual high water-level period. Hydrographs show seasonal and annual changes related to pumpage and recharge range from zero to 30 feet or more in some years. September 1986 water levels averaged about 10 feet higher than May 1986 levels. Between September 1985 and September 1986, the water-level rise averaged about 2 feet. (USGS) W89-02532

DATA ON GROUNDWATER QUALITY FOR THE MILLETT 1 DEGREE X 2 DEGREE QUADRANGLE, CENTRAL NEVADA, Geological Survey, Carson City, NV. Water Re-

Geological Survey, Carson City, NV. Water Resources Div. A. H. Welch, and R. P. Williams. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-648A, 1986. 1p, 3 fig, 1 tab, 6 ref.

Descriptors: *Water quality data, *Groundwater, *Nevada, *Maps, Data collections.

Water quality data for groundwater were compiled for the Millett 1 degree x 2 degree quadrangle which covers a portion of central Nevada. Chemical characteristics of the water are shown on a map (at a scale of 1:250,000) and on trilinear diagrams for the major ions. The data for the area are also presented in a table. (USGS) W89-02533

DATA ON GROUNDWATER QUALITY FOR THE ELKO I DEGREE X 2 DEGREE QUAD-RANGLE, EASTERN NEVADA, Geological Survey, Carson City, NV. Water Re-

Geological Survey, Carson City, NV. Water Resources Div.
A. H. Welch, and R. P. Williams.
Available from OFSS, USGS, Box 25425, Denver,
CO 80225. USGS Open-File Report 85-648B, 1986.
1p, 1 fig, 1 tab, 4 ref.

Descriptors: *Water quality data, *Groundwater, *Nevada, *Maps, Data collections.

Water quality data for groundwater were compiled for the Elko 1 degree x 2 degree quadrangle which covers a portion of Eastern Nevada. Chemical characteristics of the water are shown on a map (at a scale of 1:250,000) and on trilinear diagrams for the major ions. The data for the area are also presented in a table. (USGS) W89-02534

DATA ON GROUNDWATER QUALITY FOR THE ELY 1 DEGREE X 2 DEGREE QUADRAN-GLE, EASTERN NEVADA, Geological Survey, Carson City, NV. Water Re-

Geological Survey, Carson City, NV. Water Resources Div.
A. H. Welch, and R. P. Williams.
Available from OFSS, USGS, Box 25425, Denver,
CO 80225, USGS Open-File Report 85-648C, 1986.
1p, 1 fig, 1 tab, 7 ref.

Descriptors: *Water quality data, *Groundwater, *Nevada, *Maps, Data collections.

Water quality data for groundwater were compiled for the Ely 1 degree x 2 degree quadrangle which covers a portion of eastern Nevada. Chemical characteristics of the water are shown on a map (at a scale of 1:250,000) and on trilinear diagrams for the major ions. The data for the area are also presented in a table. (USGS) W89-02535

DATA ON GROUNDWATER QUALITY FOR THE LUND 1 DEGREE X 2 DEGREE QUADRANGLE, EASTERN NEVADA,

Geological Survey, Carson City, NV. Water Resources Div.

Sources Div.
A. H. Welch, and R. P. Williams.
Available from OFSS, USGS, Box 25425, Denver,
CO 80225. USGS Open-File Report 85-648D,
1986. 1p, 1 fig, 1 tab, 6 ref.

Descriptors: *Water quality data, *Groundwater, *Nevada, *Maps, Data collections.

Water quality data for groundwater were compiled for the Lund 1 degree x 2 degree quadrangle which covers a portion of eastern Nevada. Chemical characteristics of the water are shown on a map (at a scale of 1:250,000) and on trilinear diagrams for the major ions. The data for the area are also presented in a table. (USGS) presented in W89-02536

DATA ON GROUNDWATER QUALITY FOR THE MCDERMITT ONE DEGREE X TWO DEGREE QUADRANGLE, NORTHERN NEVADA

Geological Survey, Carson City, NV. Water Resources Div.

Sources Div.

A. H. Welch, and R. P. Williams.

Available from OFSS, USGS, Box 25425, Denver,

CO 80225, USGS Open-File Report 85-648E, 1987. 1p, 3 fig, 1 tab, 9 ref.

Descriptors: *Groundwater, *Nevada, *Groundwater quality, *Maps, Data collections, Water quality.

Water quality data for groundwater were compiled for the McDermitt 1 degree x 2 degree quadrangle which covers a portion of northern Nevada. Chemical characteristics of the water are shown on a map (at a scale of 1:250,000) and on trilinear diagrams for the major ions. The data for the area are also presented in a table. (USGS) W89-02537

DATA ON GROUNDWATER QUALITY FOR THE LOVELOCK ONE DEGREE X TWO DEGREE QUADRANGLE, WESTERN

NEVADA, Geological Survey, Carson City, NV. Water Re-

Geological Survey, Carson City, NV. water Resources Div.
A. H. Welch, and R. P. Williams.
Available from OFSS, USGS, Box 25425, Denver,
CO 80225. USGS Open-File Report 85-648F, 1987.
1p, 3 fig, 1 tab, 9 ref.

Descriptors: *Groundwater, *Nevada, *Groundwater quality, *Maps, Data collections, Water quality

Water quality data for groundwater has been compiled for the Lovelock 1 degree x 2 degree quadrangle which covers a portion of western Nevada. Chemical characteristics of the water are shown on a map (at a scale of 1:250,000) and on trilinear diagrams for the major ions. The data for the area are also presented in a table. (USGS) W89-02538

DATA ON GROUNDWATER QUALITY FOR THE WINNEMUCCA ONE DEGREE X TWO DEGREE QUADRANGLE, CENTRAL NEVADA, Geological Survey, Carson City, NV. Water Re-

Geological Survey, Cassin Company, Control of the Company, Company

Descriptors: *Groundwater, *Nevada, *Groundwater quality, *Maps, Data collections.

Water quality data for groundwater has been compiled for the Winnemucca 1 degree x 2 degree quadrangle which covers a portion of central Nevada. Chemical characteristics of the water are shown on a map (at a scale of 1:250,000) and on trilinear diagrams for the major ions. The data for the area are also presented in a table. (USGS) W89-02539

Group 7C-Evaluation, Processing and Publication

DATA ON GROUNDWATER QUALITY FOR THE RENO ONE DEGREE X TWO DEGREE QUADRANGLE, WESTERN NEVADA, Geological Survey, Carson City, NV. Water Re-

sources Div.

A. H. Welch, and R. P. Williams.

Available from OFSS, USGS, Box 25425, Denver,

CO 80225. USGS Open-File Report 85-648H,

1987. 1p, 3 fig, 1 tab, 20 ref.

Descriptors: *Groundwater, *Nevada, *Groundwater quality, *Maps, Data collections, Water quality.

Water quality data for groundwater has been compiled for the Reno 1 degree x 2 degree quadrangle which covers a portion of western Nevada. Chemical characteristics of the water are shown on a map (at a scale of 1:250,000) and on trilinear diagrams for the major ions. The data for the area is also presented in a table. (USGS)

DATA ON GROUNDWATER QUALITY FOR THE WALKER LAKE ONE DEGREE X TWO DEGREE QUADRANGLE, WESTERN NEVADA AND EASTERN CALIFORNIA, Geological Survey, Helena, MT. Water Resources Div.

Geological Survey, Reiena, M.1. water Resources Div. A. H. Welch, and R. P. Williams. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-648I, 1987. lp, 3 fig, 1 tab, 12 ref.

Descriptors: *Groundwater, *Nevada, *Groundwater quality, *Maps, *California, Water quality, Data collections.

Water quality data for groundwater has been com-piled for the Walker Lake 1 degree x 2 degree quadrangle which covers a portion of western Nevada and eastern California. Chemical charac-teristics of the water are shown on a map (at a scale of 1:250,000) and on trilinear diagrams for the major ions. The data for the area are also presented in a table. (USGS) W89-02541

DATA ON GROUNDWATER QUALITY FOR THE TONOPAH ONE DEGREE X TWO DEGREE QUADRANGLE, CENTRAL NEVADA

Geological Survey, Carson City, NV. Water Re-

Sources Div.

A. H. Welch, and R. P. Williams.

Available from OFSS, USGS, Box 25425, Denver,
CO 80225, USGS Open-File Report 85-648J, 1987. 1p. 3 fig. 1 tab. 7 ref

Descriptors: *Groundwater, *Nevada, *Groundwater quality, *Maps, Data collections, Water quality.

Water quality data for groundwater has been compiled for the Tonopah 1 degree x 2 degree quadrangle which covers a portion of central Nevada. Chemical characteristics of water are shown on a map (at a scale of 1:250,000) and on trilinear diagrams for the major ions. The data for the area are also presented in a table. (USGS) W89-02542

DATA ON GROUNDWATER QUALITY FOR THE WESTERN NEVADA PART OF THE GOLDFIELD ONE DEGREE X TWO DEGREE QUADRANGLE, Geological Survey, Carson City, NV. Water Re-

sources Div.

A. H. Welch, and R. P. Williams.

Available from OFSS, USGS, Box 25425, Denver,

CO 80225. USGS Open-File Report 85-648K,

1987. 1p, 3 fig, 1 tab, 8 ref.

Descriptors: *Groundwater, *Nevada, *Ground-water quality, *Maps, Water quality, Data collec-

Water quality data for groundwater has been compiled for the Goldfield 1 degree x 2 degree quadrangle which covers a portion of western Nevada.

Chemical characteristics of the water are shown on a map (at a scale of 1:250,000) and on trilinear diagrams for the major ions. The data for the area are also presented in a table. (USGS) W89-025643

DATA ON GROUNDWATER QUALITY FOR THE CALIENTE ONE DEGREE X TWO DEGREE QUADRANGLE, EASTERN NEVADA, Geological Survey, Carson City, NV. Water Re-

Octobigida Survey, Cataban Santon, Sources Div. A. H. Welch, and R. P. Williams. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-648L, 1987. 1n. 3 fig. 1 tab. 5 ref.

Descriptors: *Groundwater, *Nevada, *Groundwater quality, *Maps, Water quality, Data collec-

Water quality data for groundwater has been compiled for the Caliente 1 degree x two degree quadrangle which covers a portion of eastern Nevada. Chemical characteristics of the water are shown on a map (at a scale of 1:250,000) and on trilinear diagrams for the major ions. The data for the area are also presented in a table. (USGS) W89-02544

DATA ON GROUNDWATER QUALITY FOR THE WESTERN NEVADA PART OF THE DEATH VALLEY ONE DEGREE X TWO DEGREE QUADRANGLE, Geological Survey, Carson City, NV. Water Resources Div.

sources Div. A. H. Welch, and R. P. Williams. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-648M, 1987. 1p, 3 fig. 1 tab, 5 ref.

Descriptors: *Groundwater, *Nevada, *Groundwater quality, *Maps, Water quality, Data collec-

Water quality data for groundwater has been compiled for the Nevada part of the Death Valley 1 degree x 2 degree quadrangle which covers a portion of western Nevada. Chemical characteristics of the water are shown on a map (at a scale of 1:250,000) and on trilinear diagrams for the major ions. The data for the area are also presented in a table. (USGS)
W89-02545

DATA ON GROUNDWATER QUALITY FOR THE SOUTHERN NEVADA PART OF THE KINGMAN ONE DEGREE X TWO DEGREE QUADRANGLE,

Geological Survey, Carson City, NV. Water Re-

A. H. Welch, and R. P. Williams. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-648N, 1987. 1p, 3 fig, 1 tab, 2 ref.

Descriptors: *Groundwater, *Nevada, *Groundwater quality, *Maps, Data collections, Water

Water quality data for groundwater were compiled for the Kingman 1 degree x 2 degree quadrangle which covers a portion of southern Nevada. Chemical characteristics of the water are shown on a map (at a scale of 1250,000) and on trilinear diagrams for the major ions. The data for the area are also presented in a table. (USGS) W89-02546

MICROCOMPUTER PROGRAM DEVELOP-MENT FOR ON-FARM IRRIGATION SYS-TEMS PLANNING,

Idaho Univ., Moscow. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 6A. W89-02550

WATER RESOURCES INVESTIGATIONS IN TENNESSEE: PROGRAMS AND ACTIVITIES

OF THE U.S. GEOLOGICAL SURVEY, 1987-

Geological Survey, Nashville, TN. Water Resources Div.

F. Quinones, B. H. Balthrop, and E. G. Baker. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 88-322, May 1988. 66p, 3 tab

Descriptors: *Groundwater, *Surface water, *Water quality, *Suspended sediments, *Water use, *Flood frequency, *Tennessee, *Hydrologic data Data collections

This report contains a summation of 44 projects which were active in the Tennessee District during 1987 and 1988. Given in each summary is the name of the project chief, the objective of the project, the progress or results of the study to date, and the name of the cooperator. Hydrologic data are the backbone of the investigations conducted by the U.S Geological Survey (USGS). The basic data programs conducted by the Tennessee District provide streamflow, quality of water, and groundwater levels information essential to the assessment and management of the State's water resources. Long-term streamflow, quality of water, and groundwater levels network are operated as part of the Hydrologic Data Section. Field operations are about equally divided among field offices in Memphis, Nashville, and Knoxville. A staff of about 40 engineers, hydrologists, and hydrologic technicians labor in the operation of the long-term network as well as short-term efforts in support of areal investigations. The data collected as part of the networks are published in the series of annual data reports. (USGS) W89-02559

WATER QUALITY DATA (JULY 1986 THROUGH SEPTEMBER 1987) AND STATIS-TICAL SUMMARIES (MARCH 1985 THROUGH SEPTEMBER 1987) FOR THE CLARK FORK AND SELECTED TRIBUTARIES FROM DEER LODGE TO MISSOULA, MON-

Geological Survey, Helena, MT. Water Resources

For primary bibliographic entry see Field 5B. W89-02566

ELECTED HYDROLOGIC DATA FOR PAH-VANT VALLEY AND ADJACENT AREAS, MIL-LARD COUNTY, UTAH, 1987.

Geological Survey, Denver, CO.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 88-195. June 1988. 151p, 1 plate, 1 fig, 9 tab, 5 ref.

Descriptors: *Utah, *Pahvant Valley, *Ground-water data, *Well data, Water levels, Discharge, Well logs, Water quality, Spring data, Data collec-

This report contains hydrologic data collected in Pahvant Valley and adjacent areas from 1909 to 1987. The area is located in west-central Utah, 1987. The area is located in west-central Utan, within the basin and Range physiographic province, and includes about 1,600 square miles. The report contains information about wells including well completions, drillers' logs, water levels, flowing-well discharges, and chemical quality. It also includes spring and surface-water site data. (USGS) W89-02569

HYDROLOGIC DATA FOR COMPUTATION OF SEDIMENT DISCHARGE, TOUTLE AND NORTH FORK TOUTLE RIVERS NEAR MOUNT ST. HELENS, WASHINGTON, 1980-84. Geological Survey, Vancouver, WA. Water Re sources Div.

D. Childers, S. E. Hammond, and W. P. Johnson. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-548, 1988. 117p, 3 fig, 17 tab, 6 ref.

Evaluation, Processing and Publication—Group 7C

Descriptors: *Mt. St. Helens, *Washington, *Fluvial sediments, *Sediment transport, *Sediment load, *Bed load, *Flood peaks, Sediment-carrying capacity, Suspended sediments, Hydraulic geometry, Fluid mechanics, Peak loads, Hydrology, Data collections, Volcanoes.

Immediately after the devastating May 18, 1980, eruption of Mount St. Helens, a program was initiated by the U.S. Geological Survey to study the streamflow and sediment characteristics of streams impacted by the eruption. Some of the data gathered in that program are presented in this report. Data are presented for two key sites in the Toutle River basin: North Fork Toutle River near Toutie River basin: North Fork Toutie River near Kid Valley, and Toutie River at Tower Road, near Silver Lake. The types of data presented are appropriate for use with sediment transport formulas; however, the data are also intended for use in a wide variety of additional applications. The data presented in this report are unique because they delineate flow conditions presented in the control of the control delineate flow conditions possessing great potential fo sediment transport. The data define unusually high suspended-sediment concentration. Data defining hydraulic, peak discharge, suspended-sedi-ment, and bed-material characteristics are presented. (USGS) W89-02571

SELECTED GROUNDWATER INFORMATION FOR THE COLUMBIA PLATEAU REGIONAL AQUIFER SYSTEM, WASHINGTON AND OREGON, 1982-1995: VOLUME I, GEOHYDRO-LOGY,

Geological Survey, Tacoma, WA. Water Resources Div.

A vailable from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 88-182, 1988. 236p, 2 fig, 1 tab, 13 ref.

Descriptors: *Geohydrology, *Well data, *Columbia Plateau, *Washington, *Oregon, *Groundwater data, Hydrologic data, Data collections, Geohydrologic boundaries, Regional Aquifer-System Analysis Program (RASA).

This data report presents groundwater information collected and analyzed as part of the U.S. Geological Survey's Columbia Plateau Regional Aquifer System Analysis study. The information was gathered from July 1982 through September 1985 in the part of the aquifer system in central and eastern Washington, and north-central and eastern Oregon. The report consists of three volumes: volume I, geohydrology; volume II, water levels; and volume III, groundwater quality. (See also W89-02573) (USGS)

SELECTED GROUNDWATER INFORMATION FOR THE COLUMBIA PLATEAU REGIONAL AQUIFER SYSTEM, WASHINGTON AND OREGON, 1982-1995: VOLUME II, WATER LEVELS.

Geological Survey, Tacoma, WA. Water Resources Div.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 88-183, 1988. 136p, 2 fig, 1 tab, 13 ref.

Descriptors: *Water level, *Groundwater data, *Groundwater level, *Well data, *Columbia Plateau, *Washington, *Oregon, Hydrologic data, Data collections, Regional Aquifer-System Analysis Program (RASA).

This data report presents groundwater information collected and analyzed as part of the U.S. Geological Survey's Columbia Plateau Regional Aquifer System Analysis study. The information was gathered from July 1982 through September 1985 in tered from July 1952 through september 1963 in the part of the aquifer system in central and eastern Washington, and north-central and eastern Oregon. The report consists of three volumes: volume I, geohydrology; volume II, water levels; and volume III, groundwater quality. (See also W89-02572) (USGS) W89-02573

GENERALIZED POTENTIOMETRIC SURFACE OF THE SPARTA-MEMPHIS AQUIFER, EASTERN ARKANSAS, SPRING 1980, Geological Survey, Little Rock, AR. Water Resources Div. D. J. Ackerman

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 87-4282, 1987. 1 sheet, 3 fig, 16 ref.

Descriptors: *Maps, *Potentiometric level, *Groundwater level, *Arkansas, Groundwater, Sparta Sand, Memphis Sand, Sparta-Memphis aq-uifer, Water level.

A map shows generalized contours of the altitude of water levels for wells completed in the Sparta-Memphis aquifer in eastern Arkansas. Most water-level measurements used in constructing the map were from the spring of 1980, but supplemental measurements from other years indicated no long-term change in water levels. Hydrographs for selected wells are included to show trends and lack of trends in water-level changes. The aquifer in the Sparta Sand and Memphis Sand of Eocene age which consists of fine to medium sand interbedded with salt, clay, and lignite. The aquifer supplies much of the water used for industry and public supply for eastern Arkansas. Some irrigation users also obtain supplies from the aquifer. Cones of depression caused by pumpage for industrial and public supplies occur near Camden, El Dorado, Magnolia, Pine Buff, and West Memphis. (USGS) W89-02575

U.S. GEOLOGICAL SURVEY URBAN-STORM-WATER DATA BASE OF CONSTITUENT STORM LOADS; CHARACTERISTICS OF RAINFALL, RUNOFF, AND ANTECEDENT CONDITIONS; AND BASIN CHARACTERIS-

Geological Survey, Denver, CO. Water Resources M. H. Mustard, N. E. Driver, J. Chrv. and B. G.

M. H. Mustard, N. E. Driver, J. Chry, and B. G. Hansen.
Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 87-4036, 1987. 328p, 4 fig. 293 tab, 17 ref.

Descriptors: *United States, *Water pollution sources, *Data collections, *Urban runoff, *Storm runoff, *Urban areas, Water quality, Land use.

A data base which consists of constituent storm loads, characteristics of rainfall, runoff, and antecedent conditions, and basin characteristics measured at most of the stations in the U.S. Geological Survey urban-stormwater data-collection network in metropolitan areas throughout the United States has been compiled. Tables of these constituents storm loads and characteristics, are presented in storm loads and characteristics are presented in this report. The data base also is available on magnetic tape. The data represent 1,144 storms at 97 stations in 21 metropolitan areas. Storm loads for 18 constituents and 15 characteristics of rainfor 18 constituents and 15 characteristics of rainfall, runoff, and antecedent conditions are reported. Twenty-eight selected basin characteristics also are reported, including 11 categories of land use. (USGS) W89-02581

WATER LEVEL MEASUREMENTS 1981-85 AND CHEMICAL ANALYSES 1978-85, RED RIVER ALLUVIAL AQUIFER, RED RIVER VALLEY, LOUISIANA,

Geological Survey, Alexandria, LA. Water Resources Div.

Sources Div.
C. W. Smoot, and J. R. Guillot.
Available from OFSS, USGS, Box 25425, Denver,
CO 80225. USGS Open-File Report 87-541, 1988.
261p, 2 fig, 19 tab, 11 ref.

Descriptors: *Water level, *Water quality, *Groundwater, *Groundwater data, *Louisiana, *Red River Valley, Alluvial aquifers, Observations wells, Data collections, Red River.

Locks and dams under construction on the Red River in Louisiana will probably affect water levels and water quality in the Red River alluvial aquifer. Water levels measured in the Red River

alluvial aquifer from January 1981 to Deci alluvial aquifer from January 1981 to December 1985 document preconstruction water level fluctuations in wells in the aquifer. Chemical analyses of samples collected from January 1978 to December 1985 from wells in the Red River alluvial aquifer document the quality of water in the aquifer. In the vicinity of Lock and Dam 1, the water level measurements and water quality samples after December 1983 document postconstruction. Water levels were measured for 404 wells, and water quality samples were collected from 178 wells in the aquifer. (USGS) fer (USGS) W89-02582

CALIBRATION OF A DISSOLVED-SOLIDS MODEL FOR THE YAMPA RIVER BASIN BE-TWEEN STEAMBOAT SPRINGS AND MAY-BELL, NORTHWESTERN COLORADO, Geological Survey, Lakewood, CO. Water Resources Div. For primary bibliographic entry see Field 5B. W89-02591

SURFACE WATER QUALITY CHARACTERISTICS IN THE UPPER NORTH FORK GUNNISON RIVER BASIN, COLORADO, Geological Survey, Lakewood, CO. Water Re-For primary bibliographic entry see Field 5B. W89-02593

JANUARY 1987 WATER LEVELS, AND DATA RELATED TO WATER LEVEL CHANGES, WESTERN AND SOUTH-CENTRAL KANSAS, Geological Survey, Lawrence, KS. Water Re sources Div For primary bibliographic entry see Field 2F. W89-02594

ANALYTICALLY-DERIVED SENSITIVITIES IN ONE-DIMENSIONAL MODELS OF SOLUTE TRANSPORT IN POROUS MEDIA, Geological Survey, Reston, VA. Water Resources

For primary bibliographic entry see Field 5B. W89-02595

COMPUTER-PROGRAM DOCUMENTATION OF AN INTERACTIVE-ACCOUNTING MODEL TO SIMULATE STREAMFLOW, WATER QUALITY, AND WATER-SUPPLY OPERATIONS IN A RIVER BASIN, Geological Survey, Denver, CO. Water Resources

A W Burns

A. w. Burns. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Water Resources Investigations Report 88-4012, 1988. 241p, 20 fig. 14 ref.

Descriptors: *Water supply, *Streamflow, *Water quality, *Model studies, *Computer models, River basins, Simulation analysis, Geochemistry, Water

This report describes an interactive-accounting model used to simulate streamflow, chemical-constituent concentrations and loads, and water-supply operations in a river basin. The model uses regression equations to compute flow from incremental (internode) drainage areas. Conservative chemical constituents (typically dissolved solids) also are computed from respection equations. Both flow constituents (typically dissolved solids) also are computed from regression equations. Both flow and water quality loads are accumulated downstream. Optionally, the model simulates the water use and the simplified groundwater systems of a basin. Water users include agricultural, municipal, industrial, and in-stream users, and reservoir operators. Water users list their potential water sources, including direct diversions, groundwater pumpage, interbasin imports, or reservoir releases, in the order in which they will be used. Direct diversions conform to basinwide water law priorities. The model is interactive, and although the input data exist in files, the user can modify them interactive, and refauter of the model is its colorgraphic-output options. This report includes a description of the model, organizational charts of

Group 7C—Evaluation, Processing and Publication

subroutines, and examples of the graphics. Detailed format instructions for the input data, example files of input data, definitions of program variables, and listing of the FORTRAN source code are Attachments to the report. (USGS) W89-02600

ANNUAL YIELD AND SELECTED HYDRO-LOGIC DATA FOR THE ARKANSAS RIVER BASIN COMPACT, ARKANSAS-OKLAHOMA, 1987 WATER YEAR, Geological Survey, Little Rock, AR. Water Re-sources Div.

For primary bibliographic entry see Field 2E. W89-02602

SEDIMENT-DATA SOURCES AND ESTIMATED ANNUAL SUSPENDED-SEDIMENT LOADS OF RIVERS AND STREAMS IN COLO-

Geological Survey, Denver, CO. Water Resources

For primary bibliographic entry see Field 2J. W89-02604

WATER QUALITY DATA FOR ORWELL RESERVOIR AND THE OTTER TAIL RIVER NEAR FERGUS FALLS, MINNESOTA,
Geological Survey, St. Paul, MN. Water Re-

sources Div. For primary bibliographic entry see Field 5B. W89-02605

SNOW COVER, CYCLOGENESIS AND CY-CLONE TRAJECTORIES, Illinois Univ. at Urbana-Champaign. Dept. of At-mospheric Sciences. primary bibliographic entry see Field 2C.

RELATIONSHIP BETWEEN SNOW COVER AND ATMOSPHERIC THERMAL AND CIRCU-LATION ANOMALIES, Nebraska Univ., Lincoln. Dept. of Geography. For primary bibliographic entry see Field 2C. W89-02608

PROGRESSION OF REGIONAL SNOW MELT, Lamont-Doherty Geological Observatory, Palisades, NY.

For primary bibliographic entry see Field 2C. W89-02610

SOOT FROM ARCTIC HAZE: RADIATIVE EF-FECTS ON THE ARCTIC SNOWPACK, Washington Univ., Seattle. Dept. of Atmospheric

Sciences For primary bibliographic entry see Field 2C. W89-02611

SNOW COVER RECORD IN EURASIA, National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center. For primary bibliographic entry see Field 2C. W89-02612

SNOW COVER IN REAL TIME MONITORING, National Environmental Satellite, Data, and Information Service, Washington, DC. Climate Analysis Center.

For primary bibliographic entry see Field 2C. W89-02615

NORTHERN HEMISPHERE SNOW AND ICE

CHART OF NOAA/NESDIS,
National Environmental Satellite, Data, and Information Service, Washington, DC.
For primary bibliographic entry see Field 2C.
W89-02616

SNOW COVER DATA: STATUS AND FUTURE PROSPECTS,

Cooperative Inst. for Research in Environmental Science, Boulder, CO. For primary bibliographic entry see Field 7B. W89-02618

COMPARISON OF NORTHERN HEMI-SPHERE SNOW COVER DATA SETS, Maryland Univ., College Park. Dept. of Meteorol-

Maryland Univ., College Park. Dept. of Meteorology.

A. Robock, and J. Scialdone.

Available from the National Technical Information Service, Springfield, VA 22161, as DE86-011983. Price codes: Al 2 in paper copy; A01 in microfiche. In: Snow Watch *85. Glaciological Data Report GD-18. March 1986. p 141-160. 10 fig, 1 tab, 5 ref. NOAA Grant NA84AA-H-00026 and NSF Grant ATM-8213184.

Descriptors: *Snow cover, *Satellite technology, *Remote sensing, *Meteorological data collection, Climatology, Maps, Charts, Comparison studies, Estimating.

Four Northern Hemisphere snow cover data sets were compared on a weekly basis for the 25-month period, July 1981-July 1983. The data sets are the NOAA (National Oceanic and Atmospheric Administration)/NESDIS (National Environmental Satellite, Data, and Information Service) Weekly Snow and Ice Chart, the Composite Minimum Brightness (CMB) Chart, the United States Weekly Weather and Crop Bulletin, and Air Force data. The NOAA/NESDIS Chart is produced through the use of photo-interpretation of visible satellite imagery and ground observations. The U.S. Crop Bulletin is also done manually, using only ground observations. The CMB Chart and the Air Force data are both produced using automated processes, the first by way of yriole satellite imagery and the second by way of ground observations, climatology, satellite observations, and persistence. Since the NOAA/NESDIS Chart is the only standard and complete data set dating back to the mid-1960's, it is used as the basis for the study. The CMB and NOAA/NESDIS Chart are compared. The CMB frequently overestimated snow cover, especially the southward extent of the main Arctic snow boundary and areas far from the snow boundary which were not present on the NOAA/NESDIS Chart. On numerous occasions, the outline of mountain ranges was either distorted or totally missed by the CMB. The CMB also under-Four Northern Hemisphere snow cover data sets line of mountain ranges was either distorted or totally missed by the CMB. The CMB also underestimated snow cover, especially in densely populated forested areas. Other regions underestimated by the CMB can be attributed to the bias factor of by the CMB can be attributed to the bias factor of the NOAA/NESDIS Chart (the latter uses the latest snow cover information while the CMB is composited over a week). The U.S. Crop Bulletin agreed fairly well with the NOAA/NESDIS Chart east of the Rockies, but differed to the west due to the sparse network of ground observation stations. The Air Force data also overestimated snow cover when compared to the NOAA/NESDIS Chart. (See also W89-02606) (Author's abstract) abstract) W89-02619

RETRIEVAL OF SNOW WATER EQUIVALENT FROM NIMBUS-7 SMMR DATA, Helsinki Univ. of Technology, Espoo (Finland). Dept. of Electrical Engineering. For primary bibliographic entry see Field 7B. W89-02621

NIMBUS-7 SMMR SNOW COVER DATA, National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center. A. T. C. Chang. Available from the National Technical Information Service, Springfield, VA 22161, as DE36-011983. Price codes: A12 in paper copy; A01 in microfiche. IN: Snow Watch '85. Glaciological Data Report GD-18. March 1986. p 181-187. 3 fig, 13 ref.

Descriptors: *Snow cover, *Snow pack, *Satellite technology, *Remote sensing, *Meteorological data collection, *Radiometry, Climatology, Maps, Microwaves.

Snow cover maps are produced routinely by NOAA (National Oceanic and Atmospheric Ad-

ministration)/NESDIS (National Environmental Satellite, Data, and Information Service) and by USAFGWC (U.S. Air Force Global Weather Central). Studies concluded that the gross features of the snow cover are well represented; however, the the snow cover are well represented; however, the fine structure of the snow boundary is greatly generalized. The NESDIS maps, which rely on data from spaceborne visible and infrared sensors, sometimes miss large snow fields due to persistent cloudiness, particularly in the fall when the snow areal extent is rapidly changing. Microwave radiation penetrating through clouds and snowpacks could provide additional information on snow fields. The Nimbus-7 space-craft, launched in 1978, carried a Schannel dual polarized Scanning Multifelds. The Nimbus-7 spacecraft, launched in 1978, carried a 5-channel dual polarized Scanning Multi-channel Microwave Radiometer (SMMR). Based on theoretical calculations, a snow covered area retrieval algorithm was developed. Global snow cover maps for the northern hemisphere were derived from SMMR data for a 5-year period (1979-1983). Comparisons with NOAA/NESDIS and USAFGWC products were conducted to evaluate and assess the accuracy of SMMR derived snow maps. In general, these sets compared well: the total snow covered area derived from SMMR is usually about 5% less than for the other two products. This is because passive microwave sensors cannot detect snow less than 2.5 cm depth due to the fact that the emission from the underlying snow is not modified very much by emission or snow is not modified very much by emission or scattering by the snowpack for a shallow snow cover. (See also W89-02606) (Author's abstract) W89-02622

EFFECTS OF SNOW COVER AND TROPICAL FORCING ON MID-LATITUDE MONTHLY MEAN CIRCULATION,

Maryland Univ., College Park. Dept. of Meteorology. For primary bibliographic entry see Field 2C. W89-02625

PARAMETERIZATION OF SNOW ALBEDO FOR CLIMATE MODELS,

Colorado Univ. at Boulder. Dept. of Geography. S. Marshall, and S. G. Warren.

Marsnau, and S. G. Warren.
 Available from the National Technical Information Service, Springfield, VA 22161, as DE86-011983.
 Price codes: A12 in paper copy; A01 in microfiche.
 IN: Snow Watch '85. Glaciological Data Report GD-18. March 1986. p 215-223. 6 fig, 2 tab, 5 ref.

Descriptors: *Snow cover, *Snow pack, *Albedo, *Climatology, Model studies, Clouds, Solar radiation, Temperature, Carbon dioxide.

General circulation models (GCMs) find that the response of climate to increases in carbon dioxide is enhanced by the snow-albedo-temperature feedback. The results are very sensitive to the assumed value of snow albedo. Snow albedo, however, is value of snow albedo. Snow albedo, however, is highly variable, and it is not calculated accurately by present-day GCMs. A study was conducted to replace the current simple empirical parameterizations of snow albedo with a physically-based parameterization which is accurate yet efficient to compute. The approach was to develop simple functions which fit the spectrally-averaged results of a detailed theoretical model of the spectral albedo of snow which uses the delta-Eddington method for multiple scattering and Mie theory for single scattering. The spectrally-averaged snow method for multiple scattering and Mie theory for single scattering. The spectrally-averaged snow albedo varies with snow grain size, solar zenith angle, snow cover thickness, underlying surface albedo (for thin snow), concentration of absorptive impurities in the snowpack, and cloud optical thickness (because clouds alter the solar spectrum at the surface). This method divides the solar spec-trum into the two broad wavebands commonly used in climate models: visible and near-infrared. (See also W89-02606) (Author's abstract) W89-02626 W89-02626

MODELLING A SEASONAL SNOW COVER, Institute of Hydrology, Wallingford (England). For primary bibliographic entry see Field 2C. W89-02627

Evaluation, Processing and Publication—Group 7C

CHARACTERISTICS OF SEASONAL SNOW COVER AS SIMULATED BY GFDL CLIMATE MODELS, National Oceanic and Atmospheric Administra-tion, Princeton, NJ. Geophysical Fluid Dynamics Lab.

For primary bibliographic entry see Field 2C. W89-02628

CO2-INDUCED CHANGES IN SEASONAL SNOW COVER SIMULATED BY THE OSU COUPLED ATMOSPHERIC-OCEAN GENERAL CIRCULATION MODEL, Oregon State Univ., Corvallis. Climatic Research

For primary bibliographic entry see Field 2C. W89-02629

REVIEW OF 183 GHZ MOISTURE PROFILE RETRIEVAL STUDIES,

Atmospheric and Environmental Research, Inc., Cambridge, MA. R. G. Isaacs.

R. C. Isaacs. Available from the National Technical Information Service, Springfield, VA. 22161, as AD-A182 417. Price codes: A14 in paper copy, A01 in microfiche. Report No. AFGL-TR-0127, April 15, 1987. Scientific Report No. 1. 45p, 12 fig, 5 tab, 47 ref,

Descriptors: *Meteorological data collection, *Data acquisition, *Water vapor, *Literature review, *Remote sensing, Data interpretation, Simulation analysis, Oceans, Resonance, Measuring in-

The feasibility of retrieving atmospheric vertical moisture profiles from millimeter wave brightness (resonance at 183.31 GHz) temperature data has been demonstrated by the studies reviewed in this report. This has been accomplished using both actual data from an aircraft borne sensor system and in simulation. These studies suggest that water vapor abundances in the lower troposphere will be and in simulation. These studies suggest that water vapor abundances in the lower troposphere will be measurable over the oceans in calm seas to an accuracy of up to 20%. Over higher emissivity land surfaces, the contrast advantage of water vapor emission against the radiometrically cold ocean background will be lost and accuracies will degrade to about 40%. In addition to this gross dependence on the type of background viewed, retrieval accuracies will depend on the precision of the coincident retrieved temperature profile, surface temperature, and surface emissivity. The characteristics of the sensor system are also factors. Channel selection is the most critical factor. Channel sensitivity and noise are also considerations. Channel selection is the most critical tactor. Channel sensitivity and noise are also considerations. The studies reviewed have generally used consistent channel sets and similar noise equivalent brightness temperature values based on current sensor technology. (Lantz-PTT) W89.0705 W89-02705

MATHEMATICAL MODELLING, Polish Academy of Sciences, Warsaw. Inst. of

Geophysics. For primary bibliographic entry see Field 2A. W89-02725

CUMULATIVE IMPACT ASSESSMENT: AP-PLICATION OF A METHODOLOGY, Argonne National Lab., IL. Energy and Environ-

Argonne National Lab., IL. Energy and Environmental Systems Div.
G. W. Witmer, M. B. Bain, J. S. Irving, R. L.
Kruger, and T. A. O'Neil.
Available from the National Technical Information
Service, Springfield, VA 22161, as DE88-003052.
Price codes: A02 in paper copy, A01 in microfiche.
Report No. CONF-8708124--1, (1987). 9p, 1 fig, 2
tab, 8 ref. DOE Contract No. W-31-109-ENG-38.

Descriptors: *Data interpretation, *Environmental effects, *Environmental impact statement, *Hydroelectric plants, Ecology, Electric power production, Snohomish River, Salmon River, Watersheds.

The Federal Energy Regulatory Commission's (FERC) Cluster Impact Assessment Procedure (CIAP) has been expanded to provide a practical

methodology for assessing potential cumulative impacts from multiple hydroelectric projects within a river basin. The objectives in designing the methodology were to allow the evaluation of a large number of combinations of proposed projects and to minimize constraints on the use of ecological knowledge for planning and regulating hydroelectric development at the river basin level. Interactive workshops and evaluative matrices were used to identify preferred development scenarios in the Snohomish (Washington) and Salmon ((daho) River Basins. Although the methodology achieved its basic objectives, some difficulties were encoun-River Basins. Although the methodology achieved its basic objectives, some difficulties were encountered. These revolved around issues of: (1) data quality and quantity; (2) alternatives analysis; (3) determination of project interactions; (4) determination of cumulative impact thresholds; and (5) the use of evaluative techniques to express degrees of impact. (Author's abstract)

PEAK/RISK/CULVERT: A PROGRAM TO COMPUTE PEAK FLOWS, HYDROLOGIC RISK, AND CIRCULAR CULVERT SIZES AT FOREST ROAD CROSSINGS,

Bureau of Land Management, Roseburg, OR. For primary bibliographic entry see Field 2E. W89-02831

SATELLITE RAINFALL RETRIEVAL BY LO-GISTIC REGRESSION,

Applied Research Corp., Landover, MD. L. S. Chiu.

L. S. Chu. Available from the National Technical Information Service, Springfield, VA. 22161, as N88-21607. Price codes: A06 in paper copy, A01 in microfiche. September 1986. 101p. 7 fig. 25 ref, 4 append. NASA-SIBR Contract NAS5-29271.

Descriptors: *Remote sensing, *Data analysis, *Satellite technology, *Rainfall, *Regression anal-ysis, *Data interpretation, *Statistical models, Sim-ulation analysis, Model studies, Statistical analysis, Clouds, Precipitation

A logistic model was developed and applied to rainfall data using as covariates the fractional rain area and a radiance measurement which is deduced from a microwave temperate-rainrate relation. It is from a microwave temperate-rainrate relation. It is demonstrated that the fractional rain area is an important covariate in the model, consistent with the use of the so-called 'Area Time Integral' in estimating total rain volume in other studies. The significance of the estimators of the model can be readily tested by a ratio of the likelihoods. This method of testing allowed identification of impor-tant covariates as well as the way in which the covariates enter into the estimation. The logistic model has been tested on the rainfall data collected tant covariates as well as the way in which the covariates enter into the estimation. The logistic model has been tested on the rainfall data collected during phase 1 and successfully predict the observation for phase 2. A major finding is the usefulness of the fractional rain area within a pixel. This parameter gives a better regression model than that which uses only the fractional area of heavy precipitation. To estimate the mean and variance of areal average rainfall, a mixed distribution model was proposed and was found to model the distribution of rainfall data in GATE quite well. The parameters of the mixed distribution model consists of two parts: a discrete probability of no rain and a continuous distribution which describes the rainy part of the mixed distribution. A model is developed to simulate observed rain fields. The simulation model preserves the lognormality and intermittency characteristics of GATE. A regression model of replacement and immigration is also developed which is capable of producing a lognormal distribution in some asymptotic limits. These asymptotic conditions are observed for large area averages (40 kms on the side) but not for small area averages (4 kms on the side) but not for small area averages (4 kms on the side). (Lantz-PTT)

EXPERIMENTAL METHOD IN GEOMOR-PHOLOGY, British Columbia Univ., Vancouver. Dept. of Ge-

For primary bibliographic entry see Field 2E.

WESTERN LAKE SURVEY, PHASE I. DATA BASE.

BASE.
Environmental Protection Agency, Washington, DC. Office of Acid Deposition, Environmental Monitoring, and Quality Assurance.
For primary bibliographic entry see Field 2H.
W89-02946

ACID PRECIPITATION IN NORTH AMERICA: 1985 ANNUAL AND SEASONAL DATA SUM-MARIES FROM ACID DEPOSITION SYSTEM

Environmental Monitoring Systems Lab., Research Triangle Park, NC.
For primary bibliographic entry see Field 5B.
W89-02997

SIMULATION OF FLOOD HYDROGRAPHS FOR GEORGIA STREAMS, Geological Survey, Doraville, GA. Water Re-

sources Div For primary bibliographic entry see Field 5E. W89-03002

ESTIMATING GENERALIZED SKEW OF THE LOG-PEARSON TYPE III DISTRIBUTION FOR ANNUAL PEAK FLOODS IN ILLINOIS, Geological Survey, Urbana, IL. Water Resources

For primary bibliographic entry see Field 2E. W89-03006

MATHEMATICAL MODELS FOR INTERPRE-TATION OF TRACER DATA IN GROUND-WATER HYDROLOGY.

International Atomic Energy Agency, Vienna (Austria). For primary bibliographic entry see Field 2F. W89-03009

GENERAL REVIEW OF METHODOLOGIES AND APPROACHES IN MATHEMATICAL MODELS FOR INTERPRETATION OF TRACER DATA IN HYDROLOGY, Ecole Nationale Superieure des Mines de Paris, Fontainebleau (France). Centre d'Information

For primary bibliographic entry see Field 2F. W89-03011

REVIEW OF EXISTING MATHEMATICAL MODELS FOR INTERPRETATION OF TRACER DATA IN HYDROLOGY, Institute of Nuclear Physics, Krakow (Poland). For primary bibliographic entry see Field 2F, W89-03012

SOLUTE TRANSPORT IN FRACTURED

ROyal Inst. of Tech., Stockholm (Sweden). Dept. of Chemical Engineering. For primary bibliographic entry see Field 2F. W89-03014

COMPUTER MODELLING OF CONFINED AQUIFER SYSTEMS FOR INTERPRETATION OF CHEMICAL AND ENVIRONMENTAL ISO-

TOPE DATA,
Niedersaechsisches Landesamt fuer Bodenforschung, Hanover (Germany, F.R.)
For primary bibliographic entry see Field 2F.
W89-03015

USE OF LINEAR COMPARTMENTAL SIMULATION APPROACH FOR QUANTITATIVE INTERPRETATION OF ISOTOPE DATA UNDER TIME VARIANT FLOW CONDITIONS,

International Atomic Energy Agency, Vienna (Austria). Div. of Research and Labs. Y. Yurtsever, B. R. Payne, and M. Gomez Martos. IN: Mathematical Models for Interpretation of Tracer Data in Groundwater Hydrology. International Atomic Energy Agency, Vienna, Austria.

Group 7C—Evaluation, Processing and Publication

1986. p 203-222, 9 fig, 3 tab, 8 ref.

Descriptors: *Tracers, *Tritium, *Groundwater movement, *Data interpretation, *Geohydrology, *Simulation analysis, *Isotopic studies, Varied flow, Hydrologic systems, Mathematical models, Linear compartmental simulation, Tritium, Groundwater movement, Groundwater storage, Model testing, Yesildene River, Turkey, Surfacegroundwater relations.

The use of environmental tritium for the quantitative evaluation of the hydrodynamic parameters of a hydrological system requires the development of a mathematical model which describes the tracer input/output relationship. The use of a multi-com-partmental mixing model of time-variant flow con-ditions is described as a tool for quantitative evaluation of environmental isotope data. The approach enables simulation of both flow and tracer distribution through the system to provide esti-mates of parameters related to flow dynamics. Environmental tritium data collected from the Ye-Environmental tritium data collected from the Yesildere River basin (Turkey) were used to develop the model. The results of the simulation indicated that the main part of the total flow in the river during the snowmelt period was provided through an active storage groundwater-flow component, while the direct surface runoff component was comparatively small. The model also provided quantitative estimates of groundwater-storage amounts involved in overall flow dynamics as well as in temporal variations in the storage volumes. as in temporal variations in the storage volumes. The calibrated compartmental model could be The calibrated compartmental model could be used to derive the transit-time distribution curves for each flow component and for the system as a whole; this is extremely valuable information for any hydrological system study. (See also W89-03009) (Shidler-PTT)

VEGETATION AND CLIMATES OF THE LAST 45,000 YEARS IN THE VICINITY OF THE NEVADA TEST SITE, SOUTH-CENTRAL NEVADA.

NevaDA, W. G. Spaulding. Available from Books and Open-File Reports Sec-tion, USGS, Box 25425, Denver, CO 80225. USGS Professional Paper 1329, 1985. 83p, 25 fig, 25 tab,

Descriptors: *Paleoclimatology, *Paleohydrology, *Data collections, *Vegetation, *Climatic data, *Nevada Test Site, Fossils, History, Ice Ages, Glaciation, Juniper trees, Deserts, Desert plants, Steppes, Pine trees, Air temperature, Precipitation, Rainfall.

Major changes in the climate of the Nevada Test Site have occurred during the last 45,000 years. Reconstructions of past vegetation are used to infer climatic conditions during that period. During the Wisconsin glacial age, from at least 45,000 years ago to about 10,000 years ago, juniper (Juniperus osteosperma) woodland was widespread below elevations of 1,800 meters on the desert lowlands. Steppe shrubs were common, as were shrubs typical of the drier phases of current woodland. Late Wisconsin subalpine conifer woodland typified by limber pine (Pinus flexilis), occurred at elevations above about 1,800 meters in the desert lowlands. Plants that are sensitive to moist habitats, are missing or are very rare in the glacial-age are missing or are very rare in the glacial-age macrofosail record. Climatic conditions at about 45,000 years ago at the Nevada Test Site were similar to those of northern Nevada at present. similar to those of northern Nevada at present. Summers were drier and colder, and winter precipitation may have exceeded current quantities by 20%. By about 30,000 years ago, annual temperature may have been 3 to 6 C less than present values. By about 18,000 years ago, the relative decrease in annual temperature is inferred to have been 6 to 7 C. Average summer temperatures were been 6 to 7 C. Average summer temperatures were 7 to 8 C cooler than those of the present, and winter precipitation exceeded present quantities by as much as 70%. There was a relative decrease in summer rainfall, and average annual precipitation probably did not exceed 40% of current quantities. Postglacial warming began as early as 16,000 years ago, and average annual temperatures probably approached present values by about 10,000 years ago. Differences exist between these paleoclimatic

reconstructions and those that indicate a 'pluvial' rainfall regime during the late Wisconsin. Temrainfail regime during the late wisconsin. I emperatures appear to have been lower and rainfall less than the values proposed in models of an equable glaciopluvial. Increased atmospheric carbon dioxide within the next 500 years probably will result in a 2 to 3 C increase in annual temperature and intensified rainfall in the Nevada Test Site region. Analogs with previous glacial-interglacial cycles indicate that this 'superinterglacial' may be or more than a relatively brief reversal in the protracted trend toward the next ice age. Current models indicate that, within the next 10,000 years, climatic conditions may be similar to those of the last glacial age. (Author's abstract) W89_03024

MIGRATION OF ACIDIC GROUNDWATER SEEPAGE FROM URANIUM-TAILINGS IM-POUNDMENTS: 3. SIMULATIONS OF THE CONCEPTUAL MODEL WITH APPLICATION TO SEEPAGE AREA A, Morwijk Enterprises, Vancouver (British Colum-

For primary bibliographic entry see Field 5B. W89-03039

MONITORING BASELINE SUSPENDED SEDI-MENT IN FORESTED BASINS: THE EFFECTS OF SAMPLING ON SUSPENDED SEDIMENT RATING CURVES.

Pacific Southwest Forest and Range Experiment Station, Arcata, CA.

For primary bibliographic entry see Field 2J. W89_03053

EXTENDED PERIOD SIMULATION WATER SYSTEMS -- DIRECT SOLUTION, Visvesvaraya Regional Coll. of Engineering, Nagpur (India). Dept. of Civil Engineering. For primary bibliographic entry see Field 5F. W89-03106

PROBABILITY AND STOCHASTIC MODEL-LING OF WATER QUALITY PARAMETERS IN THE THAMES RIVER,

Ontario Ministry of the Environment, Toronto. For primary bibliographic entry see Field 5B. W89-03135

UTILITY OF SOLUBLE REACTIVE PHOS-PHORUS MEASUREMENTS IN GREAT PHORUS MEASUREMENTS IN GREAT LAKES SURVEILLANCE PROGRAMS: A SUM-

National Oceanic and Atmospheric Administra-tion, Ann Arbor, MI. Great Lakes Environmental Research Lab.

For primary bibliographic entry see Field 5A. W89-03180

PROBABILITY DISTRIBUTION FOR CRITI-CAL DO LOCATION IN STREAMS.

Wyoming Water Research Center, Laran For primary bibliographic entry see Field 7B. W89-03292

SPREX HYDROGRAPHIC DATA REPORT, VOLUME 3 -- CHLOROPHYLL AND NUTRI-

Old Dominion Univ. Research Foundation, Norfolk, VA.

For primary bibliographic entry see Field 2L. W89-03323

MODELLING SEASONALLY FREEZING GROUND CONDITIONS,

Bristol Univ. (England). For primary bibliographic entry see Field 2C.

8. ENGINEERING WORKS

8A. Structures

CANAL DESIGN BY AN ARMOURING PROC-

Shaw Mont Newfoundland Ltd., St. John's.

P. C. Helwig.

IN: Sediment Transport in Gravel-Bed Rivers.
John Wiley and Sons, New York. 1987. p 329-352,
9 fig, 2 tab, 11 ref.

Descriptors: *Channel armoring, *Canal linings, *Canal design, *Canal construction, *Erosion control, Design flow, Design criteria, Sediment transport, Electric power production, Fluvial sediments, Mathematical studies, Flow velocity, Canada, Hydroelectric power, Shear stress.

Canada, hydroelectric power, shear stress.

The Hinds Lake Development in Newfoundland, Canada, is a medium head hydroelectric scheme (head = 220 m) having an installed capacity of 75 MW. It was completed in 1980 at a cost of \$80 million (Canadian). The Power Canal is a major feature of this development. It is a hillside canal lined with pit-run glacial till and relies upon self-armoring to resist erosion. By relying upon an armoring process the conventional armor zone was not needed, thus permitting a saving of about \$500,000 (Canadian). Subsequent operating experience has confirmed that this design approach is reliable and cost-effective when sources of suitable materials are readily available. The design studies, construction and operating experience of the canal are reviewed and a design approach using the results of recent research on armoring processes is suggested. (See also W89-02430) (Author's abstract) stract) W89-02441

RIVER BED SCOUR AND CONSTRUCTION OF STONE RIPRAP PROTECTION,

Northwest Hydraulic Consultants Ltd., North Vancouver (British Columbia). V. J. Galay, E. K. Yaremko, and M. E. Quazi

N. J. Gaiay, E. K. Taremko, and M. E. Quazi.
IN: Sediment Transport in Gravel-Bed Rivers.
John Wiley and Sons, New York. 1987. p 353-383,
20 fig, 1 tab, 41 ref.

Descriptors: *Alluvial channels, *Channel scour, Descriptors: "Annuval Channels, "Channel erosion, "Sediment erosion, "Erosion control, Design criteria, Fluvial sediments, Gravel, Sand, River beds, Channel improvement, Levees, Bank erosion, Bank protection, Vortices.

Scour, in rivers and canals, is generally the result of secondary currents or vortices that occur in conjunction with river features such as bends, imconjunction with river features such as bends, impingements, constrictions, confluences and local protrusions (rock outcrops, artificial spurs and bridge piers). Examples are presented from various gravel-bed rivers indicating the magnitude and extent of scour holes that have been developed. In some cases, scour holes have not refilled during receding high flows as is the general case for sandbed rivers. Guidelines are presented for the estimation of scour depth for design. Typically, stone riprap armoring is used as a means of protecting areas against extreme scour, but too frequently, construction practices are not adequate to ensure construction practices are not adequate to ensure that the stone armor meets design specifications. that the stone armor meets design specifications. Procedures used by various agencies in North America to monitor riprap construction are reviewed and examples provided. Design guidelines are then presented to illustrate field monitoring procedures for riprap construction. (See also W89-02430) (Author's abstract)

REVIEW OF THE STATE OF THE ART FOR UNDERWATER REPAIR USING ABRASION-RESISTANT CONCRETE.

California Univ., Berkeley. Dept. of Civil Engineering.

For primary bibliographic entry see Field 8F. W89-02781

Hydraulics-Group 8B

DYNAMIC RESERVOIR INTERACTION WITH MONTICELLO DAM,

MONTICELLO DAM,
California Univ., Richmond. Earthquake Engineering Research Center.
R. W. Clough, Y. Ghanaat, and X. F. Qiu.
Available from the National Technical Information
Service, Springfield, VA. 22161, as PB88-179023.
Price codes: A06 in paper copy, A01 in microfiche.
Report No. UCB/EERC-87/21, December 1987.
116p, 42 fig, 8 tab, 11 ref. NSF Grant ECE8512186.

Descriptors: *Earthquake engineering, *Reservoirs, *Monticello Dam, *Seismology, *Structural behavior, Hydraulic structures, Dams, Hydrodynamics, Model studies, Computer programs, Prediction.

grams, Prediction.

This study of arch dam-reservoir interaction is an outgrowth of a 4-year U.S.-China cooperative research project on 'Interaction Effects in the Seismic Response of Arch Dams.' Inconsistent comparisons were obtained in that project between measured and calculated dynamic reservoir pressures induced by shaking tests of arch dams; this study was planned obtain improved understanding of the dynamic interaction mechanism. Monticello Dam, an arch dam in California designed by the U.S. Bureau of Reclamation, was chosen as the test system, and the research involved comparison of hydrodynamic pressures measured during vibration tests with results predicted analytically. A major question for this study was the significance of compressibility of the reservoir water with regard to the interaction forces applied to the dam by the reservoir, so analyses were done both including and neglecting compressibility. Results of the study showed that hydrodynamic pressures measured at the face of the vibrating dam were in reasonable order-of-magnitude agreement with analytical results. Consideration of compressibilities. measured at the face of the vibrating dam were in reasonable order-of-magnitude agreement with an-alytical results. Consideration of compressibility made little difference in this comparison, but it is recognized that the vibration frequencies of the dam and the reservoir differed enough that interaction effects would not be great. In the final phase of the study, the response of Monticello Dam to an earthquake appropriate to that location was calculated by two computer programs: ADAP-II which neglects compressibility and EACD-3D which includes it. Comparison of the results shows that reservoir compressibility had little effect on the calculated stresses in the dam if the reservoir boundaries are rigid, but use of the EACD-3D program assuming soft reservoir boundaries led to significant decreases of seismic stress. (Author's abstract)

RESIDUAL STRENGTH OF SAND FROM DAM FAILURES IN THE CHILEAN EARTHQUAKE OF MARCH 3, 1985, California Univ., Berkeley. Coll. of Engineering. For primary bibliographic entry see Field 8D. W89-02851

DESIGN OF REINFORCED GRASS WATER-

WAYS, H. W. M. Hewlett, L. A. Boorman, and M. E. Bramle

Bramley. Available from the National Technical Information Service, Springfield, VA. 22161, as PB88-181763. Price codes: A99 paper copy: A01 in microfiche. Report No. 116, 1987. 116p, 17 fig, 5 tab, 83 ref, 7

Descriptors: *Channels, *Canals, *Grassed waterways, *Hydraulic design, Design standards, Channels, Hydraulic structures, Geotechnology, Vege-

This report is a guide to engineering practice intended for use by practicing civil engineers. It sets out a procedure for the planning, design and mangement of steep grassed waterways, together with the engineering principles and considerations which apply, providing a framework within which a site-specific design may be evolved. The report incorporates the results of the full-scale field trials carried out in the UK at Jackhouse Reservoir 1986. It is emphasized that the planning and design of a grassed waterway requires good engineering

judgement. This is because not all the pertinent hydraulic, geotechnical and botanical processes can be described analytically, and the risk of damage is higher than with conventional forms of damage is higher than with conventional forms of construction. The concept of grass protection, and its enhancement by reinforcement is described along with potential applications. The steps in the overall planning and design procedure are reviewed either as a guide to using the report or simply as a checklist that various aspects have been considered. Hydraulic design, geotechnical considerations, botanical considerations, detailing and specification, and inspection and maintenance are also covered. (Lantz-PTT)

SOURIS RIVER BASIN PROJECT, SASKATCH-EWAN, CANADA - NORTH DAKOTA, U.S.A. GENERAL PLAN REPORT AND DRAFT ENVI-RONMENTAL IMPACT STATEMENT.

RUNMENTAL IMPACT STATEMENT. Army Engineer District, St. Paul, MN. Available from the National Technical Information Service, Springfield, VA 22161, as AD-A189 263. Price codes: A18 in paper copy, A01 in microfiche. Public Review Copy, November 1987. 351p, 3 fig, 6 tab, 10 append.

Descriptors: *Souris River, *Flood control, *Envi-ronmental impact statement, *Flood protection, *North Dakots, *Saskatchewan, Flood plain man-agement, International agreements, Dams, Water control, Water supply.

control, Water supply.

The authorized Souris River Basin project is a flood control project for urban and rural reaches of the Souris River in North Dakota. The project involves flood control features in Canada and the United States. Features in Canada include flood storage in Alameda and Rafferty reservoirs in Saskatchewan, Canada, and the operation of a proposed Boundary to Rafferty reservoir diversion and the existing Boundary Dam for flood control purposes in North Dakota. Features in the United States include modification of the gated outlet structure at the existing Lake Darling Dam for flood control; mitigation to U.S. Fish and Wildlife Service for project-related impacts; compensation to adversely impacted properties in reaches impacted by project operation in North Dakota and Manitoba; and a water control plan to release flood storage safely downstream. The purchase and operation of flood storage in Saskatchewan is a joint effort between Canada and the United States. When construction is completed in 1991, the When construction is completed in 1991, the project will provide water supply and flood control benefits to the Province of Saskatchewan, trol benefits to the Province of Saskatchewan, provide 100-year flood protection for the city of Minot, North Dakota, and significantly reduce flood damages along the main stem of the Souris River in North Dakota. (Lantz-PTT) W89-02937

HYDROLOGY, GEOMORPHOLOGY, AND DAM-BREAK MODELING OF THE JULY 15, 1982, LAWN LAKE DAM AND CASCADE LAKE DAM FAILURES, LARIMER COUNTY, COLO-

RADO, Geological Survey, Lakewood, CO. R. D. Jarrett, and J. E. Costa. Available from Books and Open-File Reports Sec-tion, USGS, Box 25425, Denver, CO 80225. USGS Professional Paper 1369, 1986. 78p, 70 fig, 13 tab, 33 ref, 2 plates in pocket.

Descriptors: *Dam failure, *Floods, *Geomorphology, *Model studies, *Colorado, Rocky Mountains, Earth dams, Flood peak, Flood damage, Computer models, Historic floods, Alluvial fans, Sediment discharge, Debris, Channel erosion, Sedimentation.

At approximately 0503 Mountain Daylight Time on the morning of July 15, 1982, Lawn Lake dam, a 26-ft-high earthen dam located in Rocky Mountain National Park, Colorado, failed. The dam released 674 acre-feet of water and an estimated peak discharge of 18,000 cubic feet per second down the Roaring River valley. Three people were killed and damages totaled \$31 million. Floodwaters from Lawn Lake dam overtopped a second dam, Cascade Lake dam, located 6.7 miles downstream,

which also failed. Cascade Lake dam, a 17-ft-high concrete, 12.1 acre-foot capacity dam, failed by toppling with 4.2 feet of water flowing over its crest. The flood continued down the Fall River into the town of Estes Park, which received extensive damage from the overbank flow. This report presents the setting, a summary of the causes of the dam failures, the hydrologic data and geomorphic effects of the flood. A dam-break computer model was used to evaluate the model's capabilities on high-gradient streams, to enhance and provide supplemental hydrologic information, and to evaluate various hypothetical scenarios of dam-breach development and probable impact of the failure of Cascade Lake dam. Flood peaks were 2.1 to 30 times the 500-year flood for selected locations along the flood path. Geomorphic and sedimentologic evidence suggest that it probably was the largest flood in these basins, at least since the retreat of the glaciers several thousands of years ago. Geomorphic effects of the flood resulting from the dam failures were profound. Channels were widened tens of feet and scoured from 5 to 50 feet locally. An alluvial fan of 42.3 acres, containing 364,000 cubic yards of material, was deposited at the mouth of the Roaring River. Satisfactory results were obtained from the dam-break model, but not without significant difficulties in proper operation of the model. Peak discharges from dambreak modeling reflect water-only discharges; total discharge may have been considerably higher on the Roaring River and on the Fall River immediately downstream from Cascade Lake dam from sediment and debris. Comparisons were made for hypothetical breach widths of (1) 25 feet and (2) 200 feet. They were compared with model results of the actual breach width of 55 feet. (Author's abstract) abstract) W89-03027

UPRATING THE LAUFENBURG SWISS/ GERMAN POWER STATION WITH TEN STRAFLO UNITS, Electrowatt Engineering Services Ltd., Zurich (Switzerland). For primary bibliographic entry see Field 8C. W89-03071

VIBRATION AND LEAKAGE OF WEIR

GATES, PRC Engineering International, Englewood, CO. For primary bibliographic entry see Field 8C. W89-03073

OCEAN OUTFALL SYSTEM FOR DENSE AND BUOYANT EFFLUENTS, Georgia Inst. of Tech., Atlanta. School of Civil

Engineering.
For primary bibliographic entry see Field 5E.
W89-03108

HYDROLOGIC DESIGN METHODOLOGIES FOR PREFEASIBILITY STUDIES OF SMALL-SCALE HYDRO AT UNGAUGED SITES, Acres International Ltd., Niagara Falls, NY. For primary bibliographic entry see Field 7A. W89-03129

TUNNEL AND RESERVOIR PLAN SOLUTION TO CHICAGO'S COMBINED SEWER OVER-FLOW, BASEMENT FLOODING, AND POLLU-

Metropolitan Sanitary District of Greater Chicago, For primary bibliographic entry see Field 4A. W89-03134 IL.

8B. Hydraulics

AIR DEMAND AND CONDUIT PRESSURES, STILLHOUSE HOLLOW DAM, LAMPASAS RIVER, TEXAS, Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab. E. D. Hart.

Available from the National Technical Information

Field 8-ENGINEERING WORKS

Group 8B—Hydraulics

Service, Springfield, VA. 22161 as AD-A199358. Price codes: A03 in paper copy; A01 in microfiche. Miscellaneous Paper HL-88-5, August 1988. Final Report. 28p, 11 fig. 4 tab, 3 plates, 5 ref.

Descriptors: *Intakes, *Spillways, *Air entrainment, *Pipe flow, *Dams, *Conduit pressure, *Stillhouse Hollow Dam, *Air demand, Lampasas River, Texas, Hydraulic studies, Roughness coeffi-

Tests were conducted to provide data on proto-type conduit air demand during high water dis-charges and to determine conduit losses at high Reynolds numbers (10 to the 7th power). The latter information was used to compute the conduit roughness coefficient f. Recorded data included water discharge, individual vent air demand, pres-sures at the air vent-water conduit interface, and nit piezometric pressures. A value for the mess coefficient was determined from the roughness coefficient was determined from the conduit head loss data and compared to values determined from plaster casts of the conduit wall. Some air vent velocities were found to exceed the recommended values. However, no damage was noted in the conduit at the time of the tests. Periodic inspections of the conduit were recommended, especially following extended releases. (Author's abstract) W89-02415

BLOUNTSTOWN REACH, APALACHICOLA RIVER, MOVABLE-BED MODEL STUDY,

Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab. For primary bibliographic entry see Field 2J.

JEFFERSON BARRACKS BRIDGE, MOVA-BLE-BED MODEL STUDY,

For primary bibliographic entry see Field 2J.

DESIGN OF REINFORCED GRASS WATER-

For primar W89-02859 nary bibliographic entry see Field 8A.

DEFINITE PROJECT REPORT FOR SECTION 14. EMERGENCY STREAMBANK PROTEC-TION, SANGAMON RIVER SEWAGE TREAT-MENT FACILITY, RIVERTON, ILLINOIS. Army Engineer District, Rock Island, IL. For primary bibliographic entry see Field 4D. W89-02934

EXPERIMENTAL STUDY OF FLOW IN SET-

TLING TANKS, Windsor Univ. (Ontario). Dept. of Civil Engineering.

J. A. McCorquodale, A. M. Moursi, and I. S.

JOEDDU, Vol. 114, No. 5, p 1160-1174, October 1988. 16 fig, 38 ref, append.

Descriptors: *Settling tanks, *Flow characteristics, *Wastewater treatment, *Model studies, *Turbulent flow, Mathematical models, Horizontal velocity, Wastewater facilities, Kinetic energy.

The behavior of flow in rectangular settling tanks has been studied under different flow conditions using statistical analysis of 13 configurations. The using statistical analysis of 13 configurations. The mean and root mean square (rms) velocities throughout the tank have been measured and the main features of the flow patterns, for example, the size of eddies, potential core, growth of the bound-ary layer, and the turbulence distribution within the tank have been studied. The energy balance is investigated on the basis of the mean kinetic energy and the turbulent kinetic over a. The energy and the turbulent kinetic energy. The rms of the horizontal velocity is used to represent the turbulence in the tanks. (Author's abstract)

USE OF REMOTE GAUGING TO MEASURE SEWER INVERT ELEVATIONS AND HEAD

LOSS, RJN Environmental Associates, Inc., College For primary bibliographic entry see Field 5D. W89-03280

8C. Hydraulic Machinery

DEVELOPMENTS IN THE DESIGN OF BULB TURBINES, Ljubljana Univ. (Yugoslavia). Faculty of Mechani-cal Engineering.

cal Engineering.
F. Schweiger, and J. Gregori.
International Water Power and Dam Construction
IWPCDM, Vol. 40, No. 9, p 12-15, September
1988. 9 fig, 10 ref.

Descriptors: *Bulb turbines, *Turbines, *Hydraulic turbines, *Hydraulic engineering, Hydroelectric plants, Powerplants.

A research study was carried out on bulb turbines using data on more than 100 units from various manufacturers and other sources, aimed at providing engineers with reliable and up-to-date statistical information. This work covers most units of this type, and therefore gives an overview of the present trend in bulb turbine design, although various design methods have been used. A regression function was developed that yields the average value of the hydraulic and geometric parameters of the best efficiency points pertaining to the individual units. While the type of the graph is complex, it is the first systematic approach to linking the basic bulb turbine parameters. (Sand-PTT) W89-03069 A research study was carried out on bulb turbines

CALCULATION OF PROTOTYPE CAVITA-TION CHARACTERISTICS IN LARGE BULB

Fuji Electric Co. Ltd., Kawasaki (Japan), Hydro

T. Kubota, and T. Tsukamoto. International Water Power and Dam Construction IWPCDM, Vol. 40, No. 9, p 15-18, September 1988. 6 fig, 5 ref.

Descriptors: *Cavitation, *Bulb turbines, *Turbines, *Hydraulic turbines, *Hydraulic engineering, Hydroelectric plants, Powerplants, Fluid mechanics.

Large bulb turbines have a large vertical span (diameter) between the runner top (the maximum elevation) and bottom (the minimum elevation) compared with the low head that is to be utilized. As the Froude number of a bulb turbine model will not be the same as that of the prototype in most cases, the distribution and development of cavitation at the prototype runner will differ from that observed in the model; cavitation can develop all observed in the mode; cavitation can develop an over the runner (from top to bottom) in the model, but in the prototype the cavitation might only develop around the runner top. A conversion method of the cavitation characteristics from method of the cavitation characteristics from model to prototype has not been established or stipulated in the IEC Code, so far. The pressure distributions against the vertical distance of a prototype runner was estimated by using a three-dimensional flow analysis and the cavitation characteristics observed in model tests. Using this information, a method was proposed to calculate the cavitation performance of the prototype from model test results. (Author's abstract) W89-03070

UPRATING THE LAUFENBURG SWISS/ GERMAN POWER STATION WITH TEN STRAFLO UNITS, Electrowatt Engineering Services Ltd., Zurich

Kwitzerland).

H. Miller, J. Vontobel, and K. Holler.
International Water Power and Dam Construction
IWPCDM, Vol. 40, No. 9, p 20-24, September

Descriptors: *Bulb turbines, *Hydroelectric plants, *Powerplants, *Turbines, *Hydraulic turbines,

Laufenberg hydroelectric station, Switzerland,

During the course of negotiations for extending the operating licence of the 80 year-old Laufenburg powerplant by at least another 20 years, the possibity of issuing a new license for a further 80 years was established in 1984. There was also a proviso was established in 1984. There was also a proviso in the new license that the design flow of the powerplant should be increased 40%. The analyses of various options for replacing the old units had shown that the spacing of the existing machines should be retained to conserve as much as possible should be featured to conserve as much as possione of the machine house structures and powerhouse building and that turbines with a design flow capacity of approximately 140 cu m/s, of the bulb of Straflow type, could be installed in the ten existing openings. Cost estimates for the various options examined were compared in two stages. In the first stage, four alternatives were compared from the point of view of investment costs against evaluated point to view of investment costs against evaluated energy production of view of investment costs against evaluated energy production during and after conversion. The basic time period of eight years used for this comparison was extened in the years used for this comparison was extened in the second stage to 40 years. It was assumed that all the existing machines would need to be replaced by new units of some description. Because of the considerable differences shown by the initial presen value analysis, this comparison was limited to the two most favorable alternatives of ten Straflow units or one large bulb turbine + seven Straflo units. The installation of ten Straflow units has proven the most favorable alternative from both the operational economy and exercises. both the operational economy and enery produc-tion points of view. The cost stream and downstream of the power station and the Straflow tur-bine intakes were investigated at the Test Institute bine intakes were investigated at the Test Institute for Hydraulic Structures. Hydrology and Glaciology at the Swiss Federal Institute of Technology in Zurich. Optimization tests were conducted on a 1:14 scale model turbine. As a result an overall annual energy production gain of 5 GWh was established. This was as a result of: hydraulic consequence activities in the state of the control of the state of th tour optimiziation, including the runner: 19 GWh; draft tube configuration:10 GWh: modified runner blade opening: 3 GWh. (Sand-PTT) 3 GWh: speed modification: 3 W89-03071

VALVES IN RESERVOIR OUTLETS,

Lewin Fryer and Partners, Hampton (England).

International Water Power and Dam Construction IWPCDM, Vol. 40, No. 9, p 24-29, September 1988. 6 fig, 10 ref.

Descriptors: *Valves, *Hydraulic valves, *Hydraulic engineering, *Reservoirs, Outlets.

Different types of valves that are used in reservoir outlets, and the factors influencing their selection were examined. The trend has been to choose valves which are relatively simple and rugged in design. Valves which have a higher discharge capacity, fewer parts and components which are more easily available have been favored. In view of these factors, needle valves have been supplantof these factors, needle valves have been supplanted by hollow cone valves and to a lesser extent by hollow jet valves, butterfly valves have replaced many sphere valves because of their cost advanmany sphere valves because of their cost advan-tage, and ring follower valves and slide gates are used for regulation at heads where pressure reduc-ing valves were previously employed. (Author's abstract)

VIBRATION AND LEAKAGE OF WEIR GATES,

PRC Engineering International, Englewood, CO.

B. T. A. Sagar, and I. Suharyono. International Water Power and Dam Construction IWPCDM, Vol. 40, No. 9, p 29-30, September

Descriptors: *Dams, *Weirs, *Spillway gates, *Hydraulic engineering, *Vibrations, Maganti Dam, *Indonesia, Leakage.

ENGINEERING WORKS—Field 8

Soil Mechanics—Group 8D

The spillway of the Manganti dam on the Citanduy River in Indonesia is equipped with 6 large fixed-wheel gates of the 2-tier type. Each gate has 10.5 m clearance width and 7.6 m total height. When the gates were tested early in 1984, 2 major probthe gates were tested early in 1984, 2 major problems were reported: the gates vibrated so severely that a footbridge downstream of the gates' piers was shaking, and there was excessive leakage from the gates. A review of the gate designs and drawings revealed several factors which were found to contribute to the vibration and leakage problems. Prototype studies confirmed that for gates with a downstream skin plate of 45 degrees, streamlined sloping bottoms ensure positive pressure throughout the gate base. The 45 degrees slop would: (1) eliminate vibrations; (2) reduce the downpull to almost half compared to a flat bottom; and (3) minimize the variation of downpull forces for small gate movements. (Sand-PTT) W89-03073

RUBBER SEALS FOR STEEL HYDRAULIC

GATES, For primary bibliographic entry see Field 8G. W89-03074

EFFECTS OF HYDROELECTRIC SCHEME ON FLUVIAL ECOSYSTEMS WITHIN THE SPAN-

ISH PYRENEES, Universidad Politecnica de Madrid (Spain). Escuela Tecnica Superior de Ingenieros de Montes. For primary bibliographic entry see Field 6G. W89-03138

UPGRADING HYDRO TURBINES: AN OPERATING AUTHORITY'S EXPERIENCE, Electricity Corp. of New Zealand, Wellington. E. J. Dumbleton.
International Water Power and Dam Construction IWPCDM, Vol. 40, No. 10, p 11-14, October 1988.

Descriptors: *Hydraulic machinery, *Hydroelectric plants, *Turbines, *Maintenance, *Utilities, *Upgrading, Refurbishment, New Zealand, Economic feasibility, Model testing, Pressure head.

Since 1976, the Electricity Corporation of New Zealand has upgraded, or is in the process of upgrading, 18 turbines, using a variety of designers and manufacturers from all over the world. This and manufacturers from all over the world. This article outlines the operating authority's approach to uprating and refurbishing hydro plants. Steps in the upgrade process include: identifying an economic upgrade, determining the possible efficiency gain, calculating the output, specifying the upgrade, contractual model testing, selecting the manufacturer, and follow-up with efficiency index testing after upgrading. Five examples are described according to output, pressure head, turbine speed, manufacturer, and age before upgrading. (Shidler-PTT)
W89-03152

NEW LEBRING SCHEME REPLACES THE OLDEST PLANT ON THE MUR,

Suiselectra Ingenieurunternehmung A.G., Basel.

Suscicerta ingenieuranterineitating (100, basel)
P. Bachofner.
International Water Power and Dam Construction IWPCDM, Vol. 40, No. 10, p 15-18, October 1988. 4 fig, 2 ref.

Descriptors: *Hydraulic machinery, *Hydroelectric plants, *Austria, *Maintenance, *Upgrading, Dams, Dikes, Hydraulic models, Environmental protection, Economic justification, Human population.

The new Lebring powerplant was constructed to replace the first run-of-river low-head powerplant on the river Mur, Austria, built at the beginning of this century. The original powerplant, its modifications, and the upgrading studies are described. The new Lebring plant is summarized in terms of its powerhouse, barrage, steel structures, electromechanical equipment, hydraulic model tests, dikes, and environmental redection and improvement and environmental protection and improvement. The new plant is the largest of its kind on this river, and energy generation has been increased

significantly. Replacing the old scheme with a new and modern low-head run-of-river plant proved, in this case, to be the most economical solution. This case study demonstrates that the construction of a powerplant in a densely-populated area such as central Europe is still possible, provided that ecologically-beneficial solutions can be found. (Shidler-PTT)

REHABILITATION OF THE KURATAU STA-TION IN NEW ZEALAND, Tonkin and Taylor Ltd., Auckland (New Zea-

land).

landy, J. N. Duder. International Water Power and Dam Construction IWPCDM, Vol. 40, No. 10, p 20-22, October 1988.

Descriptors: *Hydraulic machinery, *Hydroelectric plants, *New Zealand, *Maintenance, *Refurbishment, Canal construction, Canal linings, Leakage, Earthquake engineering.

After some 20 years of operation, the canal for the 6 MW Kuratau hydropower station, North Island, New Zealand, required leakage-prevention measures and improvement of earthquake resistance. A length of canal was relined with compacted ash, and the conduit forebay area was lined with concrete and shotcrete. Drainage systems were provided under the linings. Other rehabilitation works included the shotcrete repair of erosion below the spillway, improving the canal-intake gate closure under seismic conditions, adding restraint to the penstock supports and powerhouse cladding, and forming diversion banks in case of canal or pipe-conduit burst in a severe earthquake. (Author's abstract) After some 20 years of operation, the canal for the W89-03154

UPDATING AND REFURBISHING HYDRO PLANTS IN INDIA, National Hydroelectric Power Corp. Ltd., New

National Hydrocecute Fower Cap. Delhi (India).
B. R. Oberoi, and B. S. K. Naidu.
International Water Power and Dam Construction
IWPCDM, Vol. 40, No. 10, p 24-26, October 1988. 1 fig, 2 tab, 4 ref.

Descriptors: *Hydraulic machinery, *Hydroelectric machinery, *India, *Maintenance, *Refurbishment, Upgrading, Regional planning, Project planning, Economic aspects, Environmental effects, Costs, International agreements.

A national survey and subsequent review of 110 Indian power stations, with total installed capacity of 14,030 MW, revealed that 60 of them are suitable for refurbishing and uprating with substantial gains in energy production. This article presents an gains in energy production. This article presents an outline of the survey, focusing on the processing of data for strategic decisions, and the formulation of a national program for project implementation within a time frame of three to four years. The study was carried out by a national committee which took into account the identification of plants which would benefit from renovation, expenditure, the time frame, benefits in relation to costs, the pattern of funding, and identification of an implementing agency. Before a national program for refurbishment was undertaken, a major environmental analysis was conducted. The total cost of he planned renovation and uprating work is US\$212.5 million. Some contracts for imported equipment may be tied to international economic cooperation programs from countries such as the cooperation programs from countries such as the USSR, the US, Canada, Japan, the UK, and the Federal Republic of Germany. (See also W89-03157) (Shidler-PTT) W89-03155

EXTENDING THE OPERATING LIFE OF HYDRO EQUIPMENT, Merz and McLellan, Newcastle upon Tyne (Eng-

J. Taylor. International Water Power and Dam Construction IWPCDM, Vol. 40, No. 10, p 28-30, 32-34, October 1988. 4 fig, 1 ref.

Descriptors: *Hydraulic machinery, *Hydroelectric plants, *Refurbishment, *Maintenance, Mechanical equipment, Electrical equipment, Project

Forty years is generally regarded as the maximum economic life for the mechanical and electrical plant and equipment in hydro stations, with the exception of electronic equipment which may only last around 20 years. As civil engineering works have an economic life of about 80 years, it is possible to double the life of a station by rehabilitating the mechanical and electrical plant and equipment. This article discusses the planning, turbines, turbine-auxiliary equipment, generators, excitation, control equipment, transformers, switchgear, and operation and maintenance associated with such rehabilitation. (Author's abstract) W89-03156

UPRATING OF FOUR INDIAN HYDRO PLANTS.

Tata Consulting Engineers, Bombay (India).
N. R. Santhanam, and V. V. Paranjpe.
International Water Power and Dam Construction
IWPCDM, Vol. 40, No. 10, p 36-38, October 1988.

Descriptors: *Hydraulic machinery, *Hydroelectric plants, *India, *Maintenance, *Upgrading, Refurbishment, Case studies, Project planning, Civil engineering, Costs, Economic aspects, Technology, Design criteria.

gy, Design criteria.

A major program of uprating and refurbishment is under way in India; this article presents data relating to four specific renovation and uprating schemes-three plants operated by Tata Electric Companies in Maharashtra State, western India, and one owned by the Punjab State Electricity Board in Himachal Pradesh in the north of the country. This article discusses the approach adopted and the steps which were implemented at these stations. Refurbishment of such old hydroelectric plants is more economical than a complete replacement of the units. It is possible to achieve an increase in output of about 25 percent with minimal modifications to the civil works, and negligible additional cost. Entire projects can be planned in stages, so that the plant outages are minimized, and the financial burden is spread over a period of time; phasing of the work depends on the degree of urgency for each item. In refurbishing old units, the latest technological developments can be incorporated in the design, to keep abreast of modern practice. The systematic refurbishment of hydro stations allows a high degree of reliability to be achieved, and stations can be expected to give many years of efficient and trouble-free service. (See also W89-03155) (Shidler-PTT)

8D. Soil Mechanics

ASSESSMENT OF HYDROGEOLOGICAL FEATURES USING THE TECHNIQUE OF TERRAIN CLASSIFICATION,

Hong Kong Public Works Dept. Geotechnical Control Office. For primary bibliographic entry see Field 7B. W89-02372

INFLUENCE OF GROUND WATER ON SOIL-STRUCTURE INTERACTION, City Univ. of New York. For primary bibliographic entry see Field 2F. W89-02850

RESIDUAL STRENGTH OF SAND FROM DAM FAILURES IN THE CHILEAN EARTHQUAKE OF MARCH 3, 1985, California Univ., Berkeley. Coll. of Engineering. P. De Alba, H. B. Seed, E. Retamal, and R. B.

Seed.
Available from the National Technical Information Service, Springfield, VA. 22161, as PB88-174321. Price codes: A03 in paper copy, A01 in microfiche. Report No. UCB/EERC-87/11, September 1987.

Field 8-ENGINEERING WORKS

Group 8D—Soil Mechanics

45p, 17 fig, 2 tab, 7 ref. NSF Grant ECE-8411912.

Descriptors: *Soil strenght, *Dam failure, *Soil mechanics, *Earthquake engineering, *Sand strenght, *Chile, Slope stability, Hydraulic structures, Dam stability, Dams, La Marquesa Dam, La

The slope failures at La Marquesa and La Palma Dams in the Chilean earthquake of March 3, 1985 were apparently due to liquefaction of loose sand layers near the base of the embankments. The dams were low structures (4 to 10 m high) and the horizontal movements were substantial. However the configuration of the embankments after the failures suggests that the liquefied soil retained a small but significant strength after liquefaction. Field explorations provided a basis for assessing the characteristics of the liquefied sands before the earthquake occurred and analyses of the configuration of the slide material provided a basis for the characteristics of the liquefied sands before the earthquake occurred and analyses of the configuration of the slide material provided a basis for evaluating the probable ranges of residual strengths for the liquefied soils. The highest values for residual strength were obtained by assuming the driving forces to be the initial at-rest earth pressure of the core and the development of small nertia forces produced by the earthquake; similar, but generally slightly lower values, were obtained considering other failure surfaces suggested by the surface cracking and deformation patterns. For the latter analyses, it was necessary to assume a uniform residual strength along the failure surface, resulting in upper-bound strengths for these surfaces. The two cases of dam failure described are of special interest because they provide examples of the performance of very low dams, in which static stresses are quite low, under strong earthquake conditions and they also provide two additional case studies to add to the relatively sparse record of case studies from which residual strengths of liquefied soil can be determined based on field performance. (Lantz-PTT)

BEHAVIOUR OF BURIED SMALL FLEXIBLE

PIPES, McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics. For primary bibliographic entry see Field 8G. W89-03137

8E. Rock Mechanics and Geology

HYDROGEOLOGICAL PROBLEMS OF HARD ROCK AREAS OF SOUTHERN INDIA.

Deutsche Gesellschaft fuer Hamburg (Germany, F.R.). Windenergie e.V., For primary bibliographic entry see Field 2F. W89-02374

GEOLOGICAL STRUCTURE: AN IMPORTANT FACTOR CONTROLLING KARST DEVELOP-MENT,

Academia Sinica, Beijing (China). Inst. of Geography. For primary bibliographic entry see Field 2F.

8F. Concrete

W89-02733

SULFATE RESISTANCE OF MORTARS MADE USING PORTLAND CEMENT AND BLENDS OF PORTLAND CEMENT AND POZZOLAN OR SLAG.

OR SLAG, Army Engineer Waterways Experiment Station, Vicksburg, MS. Structures Lab. G. S. Wong, and T. Poole. Available from the National Technical Information Service, Springfield, VA. 22161 as AD-A199383. Price codes: A07 in paper copy; A01 in microfiche. Technical Report SL-88-34, August 1988. Final Report. 142p, 53 fig, 11 tab, 15 ref, 4 append.

Descriptors: *Sulfates, *Portland cement, *Mortar, Slag, Pozzolans, Materials testing, Cements.

Mortar bars were made from 23 Type I, 9 Type II, 2 Type V, 15 Type IP, 5 Type IS, and blends of Type I with slag and with various pozzolans in-cluding one silica fume. The bars were stored in a 5% sodium sulfate solution and monitored for changes in length and in resonant frequency. The length changes of the bars indicated that silica fume and a natural pozzolan showed impressive improvement of the blends over the use of a nonsulfate-resistant cement by itself, while blends made using slag, and other pozzolans in the amounts studied, in some cases showed only slightly improved resistance and in other cases no improvements. (Author's abstract) W89-02714

REVIEW OF THE STATE OF THE ART FOR UNDERWATER REPAIR USING ABRASION-RESISTANT CONCRETE.

California Univ., Berkeley. Dept. of Civil Engi-

Available from the National Technical Information Service, Springfield, VA. 22161. Technical Report REMR-CS-19, September 1988. Final Report. 39p, 3 fig. 8 ref.

Descriptors: *Concrete, *Maintenance, *Concrete technology, *Hydraulic structures, Materials testing, Underwater, Polymers, Concrete mixes.

Concrete hydraulic structures that are subjected to severe abrasion require periodic inspection, evalua-tion, and repair. Not only are these procedures tion, and repair. Not only are these procedures costly and sometimes disruptive, but repeated repairs also make guaranteeing the integrity of the underlying layers difficult. This review was conducted, on an international level, to identify new techniques and potential areas of research that with lead to more devices registrat restartish and might lead to more abrasion-resistant materials and more effective repair methods and that would avoid the high cost and disruptions associated with dewatering. Topics of study in this review include: (a) underwater inspection; (b) concrete mixtures; (c) underwater placement of concrete; (d) underwater compaction of concrete; (e) polymer concretes and coatings; (f) surface preparation; and (g)support vehicles. (Author's abstract) W89-02781

LOAD-SHARING LININGS: A NEW DESIGN CONCEPT FOR LARGE DIAMETER PEN-STOCKS

Electricite de France, Paris, Service de la Produc-

tion Hydraulique.
P. Bonnet, and M. Lino.

International Water Power and Dam Construction IWPCDM, Vol. 40, No. 10, p 40-42, 44-45, October 1988. 6 fig.

Descriptors: *Hydraulic structures, *Penstocks, *Linings, *Load distribution, *Mathematical models, France, Reinforced concrete, Finite element method.

A new design concept for large-diameter rein-forced-concrete penstocks has been developed in France, which can offer cost savings of up to 15 percent compared with traditional designs. The technique consists of giving the metal sheet of a continuous internal lining a mechanical function, equivalent to that of conventional rebars; it is thus known as a load-sharing lining. A calculation tech-nique, based on a three-dimensional finite-element parametric model, is used in the design process.

The model is described here, as well as two applications of the new technique, one at a refurbishment scheme and another at a new installation. (Author's abstract) W89-03158

GEOMEMBRANE LINER REDUCES LEAK-AGE IN UNDERGROUND RESERVOIR,

Cincinnati Water Works, OH. For primary bibliographic entry see Field 5F.

8G. Materials

SEDIMENT TRANSPORT IN GRAVEL-BED RIVERS

Queen Mary Coll., London (England). For primary bibliographic entry see Field 2J. W89-02430

RUBBER SEALS FOR STEEL HYDRAULIC

G Schmausser and G Hartl International Water Power and Dam Construction IWPCDM, Vol. 40, No. 9, p 34-36, September 1988. 6 fig, 2 tab, 7 ref.

Descriptors: *Hydraulic gates, *Hydraulic equipment, *Rubber seals, Strength, Friction.

High quality types of rubber which are particularly right quanty types of rubber which are particularly resistant to aging have been used for gate seals. These include natural rubber, styrene-butadiene compounds of varying hardness, and chloroprene compounds, e.g. neoprene. Chloroprene com-pounds are used particularly where the seal is subjected to high ozone levels and harsh weather conditions. These materials must meet the interna-tional specifications for the following physical properties: high tensile strength; high tear resistance; good resistance to abrasion; low water ab-sorption; and resistance to aging. Results are presented for the testing of friction behavior, force/ deflection behavior, and abrasion characteristics of various seal materials with polytetrafluoroethylene various seal materials with polytetrafluoroethylene (PTFE) cladding. From the results it is possible to calculate the necessary seal construction and thickness of the PTFE cladding for the various load conditions by taking into account the total operational movement (the amount of movement and frequency of use). At the same time, an approximate life expectancy of a particular seal can be predicted in terms of meters (total operational movement). (Sand-PTT) W89-03074

BEHAVIOUR OF BURIED SMALL FLEXIBLE

McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics A. Ghobarah, and W. K. Tso.

Canadian Journal of Civil Engineering CJCEB8, Vol. 15, No. 3, p 486-489, June 1988. 5 fig, 4 ref.

Descriptors: *Drainage systems, *Plastic pipes, *Soil composition, Materials testing, Soil mechanic, Flexible drain pipes.

An analytical and experimental investigation was conducted to study the behavior of buried small diameter flexible plastic drain pipes when subjected to surface wheel loads. Tests were conducted on drain pipes buried under sand and also typical agriculture soil samples from Southern Ontario. In addition to soil types, the effect of soil compaction on the stresses and deformation of the pipe was evaluated. The modulus of soil reaction is highly dependent on the degree of compaction of the soil evaluated. The modulus of soil reaction is highly dependent on the degree of compaction of the soil adjacent to the pipe. By using compacted sand around the pipe, the modulus of soil reaction can be increased significantly, thereby reducing the deformation of the pipe. Using the appropriate value of the modulus of soil reaction, it is shown that theoretical predictions of pipe deformation correlate well with test measurements. (Author's abstract) abstract) W89-03137

8I. Fisheries Engineering

MONITORING THE NATION'S WATERS-A NEW PERSPECTIVE.

Environmental Protection Agency, Washington, DC. Office of Toxic Substance For primary bibliographic entry see Field 5A.

Grants, Contracts, and Research Act Allotments—Group 9D

LIMNOLOGICAL AND FISHERY STUDIES ON LAKE SHARPE, A MAIN-STEM MISSOU-RI RIVER RESERVOIR, 1964-1975, Fish and Wildlife Service, Washington, DC. For primary bibliographic entry see Field 2H. W89-02423

RELATIVE ABUNDANCE AND DISTRIBUTION OF YOUNG-OF-THE-YEAR FISHES AND MINNOWS IN LAKE SHARPE, SOUTH DAKOTA.
Fish and Wildlife Service, Pierre, SD. North Cental Business of the Property of the

Fish and Windle Service, Fierre, 322. North tral Reservoir Investigations. For primary bibliographic entry see Field 2H. W89-02426

BIOLOGY OF THE WALLEYE IN LAKE SHARPE, SOUTH DAKOTA, 1964-1975, Fish and Wildlife Service, Pierre, SD. North Cen-tral Reservoir Investigations. For primary bibliographic entry see Field 2H. W89-02427

BIOLOGY OF THE YELLOW PERCH IN LAKE SHARPE, SOUTH DAKOTA, 1964-1975, Fish and Wildlife Service, Pierre, SD. North Central Reservoir Investigations.
For primary bibliographic entry see Field 2H.
W89-02428

CASE STUDY OF MINIMUM STREAMFLOW FOR FISHERY HABITAT IN THE YAMPA

Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W89-02460

INTERSTITIAL WATER QUALITY OF LAKE TROUT SPAWNING HABITAT, National Water Research Inst., Burlington (Ontar-For primary bibliographic entry see Field 5C. W89-03172

ACCOUNTING FOR EFFORT WHEN COM-PARING TROPICAL FISHERIES IN LAKES, RIVER-FLOODPLAINS, AND LAGOONS, Illinois Natural History Survey, Champaign. For primary bibliographic entry see Field 2H. W89-03269

APPLICABILITY OF FISH YIELD INDICES IN FRESHWATER AND MARINE ECOSYSTEMS, FRESHWATER AND MARINE ECOSYSTEMS, Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab. For primary bibliographic entry see Field 2H. W89-03270

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

WATER RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN MISSOURI, FISCAL YEAR 1987,
Geological Survey, Rolla, MO. Water Resources

B. J. Smith, and K. L. Jenkins. Available from OFSS, USGS, Box 25425, Denver, CO 8025. USGS Open-File Report 88-99, 1988. 66p, 8 fig. 1 tab, 121 ref.

Descriptors: *Data collections, *Water resources data, *Missouri, *Hydrologic data, *Networks, Monitoring.

Water resources activities of the U.S. Geological Survey in Missouri consist of collecting hydrologic data and making interpretive studies. Hydrologic studies in Missouri are made through three basic types of projects: (1) hydrologic data-collection

program, (2) local or areal hydrologic investiga-tions, and (3) statewide or regional studies. These projects are funded through cooperative join-funding agreements with State and local agencies, transfer of funds from other Federal agencies, and direct Federal funds. The data and the results of the investigations are published or released by either the U.S. Geological collection programs and local or areal hydrologic investigations in Missouri for fiscal year 1987 and provides a list of selected water-resources references for Missouri. (USGS) W89-02470

WATER RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN MISSOURI,

FISCAL YEAR 1987.
Geological Survey, Rolla, MO. Water Resources

Geological Survey, Norm, and Carlon Div.

Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 88-99, May 1988, 66p, 8 fig, 2 tab, 5 ref. Compiled by B. J. Smith and K. L. Jenkins.

Descriptors: *Missouri, *Hydrologic data, Data collections, Networks, Technology transfer, Information exchange.

Water resources activities of the U.S. Geological Survey in Missouri consist of collecting hydrologic data and making interpretive studies. Hydrologic studies in Missouri are made through three basic types of projects: (1) hydrologic data-collection programs, (2) local or areal hydrologic investigations, and (3) statewide or regional studies. These projects are funded through cooperative joint-funding agreements with State and local agencies, transfer of funds from other Federal agencies, and direct Federal funds. The data and the results of the investigations are published or released by either the U.S. Geological Survey or by cooperating agencies. This report describes the hydrologic data-collection programs and local or areal hydrologic investigations in Missouri for fiscal year 1987 and provides a list of selected water resources and provides a list of selected water resources references for Missouri. (USGS)
W89-02567

WATER RESOURCES INVESTIGATIONS IN TENNESSEE: PROGRAMS AND ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY, 1987-

Geological Survey, Nashville, TN. Water Re-

Georgical sulvey, sources Div. F. Quinones, B. H. Balthrop, and E. G. Baker. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 88-322, 1988.

Descriptors: *Groundwater, *Surface water, *Water quality, *Hydrologic data, *Tennessee, Data collections, Suspended sediments, Water use, Flood frequency, Information exchange.

This report contains a summation of 44 projects Inis report contains a summation of 44 projects which were active in the Tennessee District during 1987 or 1988. Given in each summary is the name of the project chief, the objective of the project, the progress or results of the study to data, and the name of the cooperator. (USGS)

WATER RESOURCES ACTIVITIES OF THE U. S. GEOLOGICAL SURVEY IN TEXAS - FISCAL

S. GEOLOGICAL SURVEY, YEAR 1987, Geological Survey, Austin, TX. Water Resources

A. A. Mitchell. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 88-100, 1988. 92p, 2 fig, 1 tab.

Descriptors: *Texas, *Groundwater, *Surface water, *Water quality, *Hydrologic data, *Data collections, Information exchange.

This report describes the activities of the Water Resources Division in Texas for fiscal year 1987. The project number, cooperating agencies, project chief, period of project, location, problem, objective, approach, progress, plans, reports in prepara-

tion, and reports published are given for each project in the Texas District. The report also includes a list of reports published or approved for publication in fiscal year 1987, and a plate showing the locations of the Subdistrict areas and active surface-water stations in Texas. (USGS) W89-02574

9D. Grants, Contracts, and Research Act Allotments

FISCAL YEAR 1986 PROGRAM REPORT (NEW YORK WATER RESOURCES INSTI-TUTE),

New York State Water Resources Research Inst., Ithaca.

K. S. Porter.

A. S. FOREZ. Available from the National Technical Information Service, Springfield, VA 22161, as PB88 214119/ AS. Price codes: A03 in paper copy; A01 in micro-fiche. Program Report G1242, February 1988. 13p,

Descriptors: *New York, *Water Research Insti-tute, *Research projects, *Information transfer, Toxic chemicals, Sediments, Data management, Microorganisms, Partitioning, Niagara River, Buf-

New York State is confronted with a serious prob-lem of sediments in the State's surface waters. The goals of the current program are to assess the continuing discharge of toxic chemicals to one of the most impacted river systems in New York State, the Niagara River System. Two research project synopses are presented: (a) Modelling and Data Management for Controlling Toxic Chemi-cals in the Niagara River Basin; and (b) Role of Microorganisms in Partitioning of Toxic Metal Pollutants in Sediment. Significant Information Transfer activities are also listed. (USGS) New York State is confronted with a serious prob-

FISCAL YEAR 1986 PROGRAM REPORT (COLORADO WATER RESOURCES RE-SEARCH INSTITUTE), Colorado State Univ., Fort Collins. Water Re-

sources Research Inst.

N. A. Evans. N. A. EVAIIS.

Available from the National Technical Information Service, Springfield, VA 22161, as PB88-180427/
AS. Price codes: A03 in paper copy; A01 in microfiche. Program Report G1214, Annual Report No.
23, August 1987. 35p. Contract No. 14-08-0001G1214. Project No. USGS G1214-01.

Descriptors: *Water Research Institute, *Research, *Information transfer, *Training, *Colorado, Conjunctive use, Groundwater management, Water law, Augmentation plans, Groundwater recharge, Geochemistry, Recharge wells, Irrigation efficiency, Water transfer, Conjunctive use, Hydrologic models, Economic evaluation, Groundwater, Nuclear magnetic resonance, Specific yield, Reservoir operation, Channel scour, Synthetic flows, Crane habitat, Groundwater pollution, Computer models, Finite method, Water reuse.

Finite method, Water reuse.

The Institute's Federal FY1986 Program consisted of six research projects focused on the following Colorado problems: (1) Conjunctive Surface-Groundwater Management - Augmentation, Exchanges and Substitute Supply; (2) Geochemical Assessment of Aquifer Recharge Effects in the Southwest Denver Basin; (3) Incentives for Improving Irrigation Efficiency in the South Platte Basin: Hydrologic and Economic Impacts: (4) Specific Yield of Denver Basin Aquifer from Nuclear Magnetic Resonance; (5) Alternatives for Meeting Crane Habitat Requirements; and (6) Reuse of Treated Wastewater by Groundwater Recharge. The Institute provided supplemental funding for the following projects: (1) Hydrologic Effect of Gravel Quarry Operations; (2) Evapotranspiration by Phreatophytes in the Closed Basin, San Luis Valley; (3) Examinations of Management Options for the South Platte River Basin; (4) Groundwater Faunas as Indicators of Groundwater Quality in the South Platte River Basin; (4) Groundwater Faunas as Indicators of Groundwater Quality in the South Platte River System; and a Chemigation-

Field 9—MANPOWER, GRANTS AND FACILITIES

Group 9D—Grants, Contracts, and Research Act Allotments

Valve Testing Program. The appropriation also helped provide an effective Institute technology transfer program, fully integrated with its water research and development program. This includes: newaletter; three publications series; a 'library list' of new water resources research reports and publications Project AWARE, designed to keep State and Federal agency personnel aware of proposed research; public water policy education (programs including slide presentations); and workshops, semiars, and small group consultations involving potential users of research products. The Colorado Legislature reaffirmed its support for water research by extending the Institute's status as the designated water research management center in Colorado for ten years. (USGS) rado for ten years. (USGS)

FISCAL YEAR 1986 PROGRAM REPORT (WY-OMING WATER RESEARCH CENTER), Wyoming Univ., Laramie. Water Resources Re-search Inst.

H. L. Bergman

Available from the National Technical Information Available from the National Technical Information Service, Springfield, VA 22161, as PB88-175963/ AS. Price codes: A04 in paper copy; A01 in micro-fiche. Program Report G1262-01, July 1987. 45p, 4 tab, 2 fig. Project No. USGS G1262-01. Contract No. 14-08-0001-G1262.

Descriptors: *Water Research Institute, *Research, *Information transfer, *Training, *Wyoming, Water quality, Organic contaminant, Groundwater, Surface water, Sediment, Eutrophication, Recreation, Economic benefits, Natural recharge, Stream discharge, Effluent streams, Crop yield, Water use, Crop production, Evapotranspiration, Water use efficiency.

Four research projects were funded under the FY 1986 program which included: (1) a field study on the movement of organic contaminants through groundwater to surface streams created by a wood-treating facility and an oil refinery's NPDES discharge indicated that oily seeps or surface dis-charges can occur into the surface stream and adversely affect the biological activity in the stream. Use of EPA ambient toxicity tests were found to be sensitive enough to detect migration of contaminated surface or groundwater into surface streams; (2) a recreational based valuation method was developed and tested to estimate the effects of change in water quality due to eutrophication of a reservoir on recreational benefits and uses. The method used sampled recreationalists on direct and indirect contact at the reservoir site with a follow-up questionnaire. The data indicated a change in up questionnaire. The tata indicated a change in some users recreational activities due to eutrophication; (3) a field study is being conducted to investigate stream-aquifer interaction phenomena in fracture permeable Paleozoic rock outcrops. in fracture permeable raieczone rock outerops.

Using streamflow discharge measurements above and below the fracture permeable rock outerop areas along with well level measurements, quantifications are supported by the support of t action of recharge due to streamflow during the entire year has shown that the groundwater system is being recharged directly from the stream at different rates during different times of the year; different rates during different times of the year; and (4) a study was undertaken to investigate the applicability of crop yield-water use models on crops (winter wheat) grown in high altitude locations (Wyoming). The FAO yield-water use model by Doorenbos and Kassam was found to predict actual yield of winter wheat as a function of maximum yield, a crop response factor and the evapotranspiration ration with fairly good reliability considering that agronomic and soil unknowns were not present in the prediction. Information transfer was done principally through a symposium proceedings on Wyoming water problems, extension activities, mailings on available publications, through a newsletter, and participation at several meetings held by groups in the State of Wyoming or water issues. (Bergman-WY U., WWRC) W89-02479

YEAR 1987 REPORT (GEORGIA RESOURCES RESEARCH INSTI-WATER TUTE),

Georgia Inst. of Tech., Atlanta. Water Resources

B. Kahn. Available from the National Technical Information Service, Springfield, VA 22161 as PB88-235742/

Available from the National Technical Information Service, Springfield, VA 22161 as PB88-235742/
AS. Price codes: A03 in paper copy; A01 in microfiche. Program Report G1416-01, May 1988. 42p.
Contract No. 14-08-0001-G1416. Project No. USGS G1416-01.

Descriptors: *Water Research Institute, *Research projects, *Research, *Information transfer, *Training, *Georgia.

The FY 1987 program included the following research projects: (1) Temporal and Spatial Variations in the Radon Content of Groundwater in the Vicinity of the Elberton Batholith of Northeastern Vicinity of the Electron batholith of Northeastern Georgia, by J. E. Noakes, J. D. Spaulding, D. B. Wenner and G. C. Simones. Radon measurements in water from 50 wells of varying depths showed higher levels near the southwest and northwest edges of the main outcrop granite than in the adjacent metamorphic terrains. The elevated levels are attributed to uranium-enriched pegmatites just below the surface. (2) Field Methods for Estimating Drought Streamflow Reduction due to Pumping from Nearby Wells, by P. J. Smith and J. F. Dowd. Four techniques - use of seepometers, minipiezometers, temperature probes, and streamflow correlations - were tested at three field locations correlations - were tested at three field locations and in the laboratory. None of the procedures was sufficiently sensitive for the field measurements. (3) The Value of Forecasting in Reservoir Operation, by A. P. Georgakakos. Statistical streamflow models were coupled with the extended linear quadratic Gaussian control method in simulation experiments for the Savannah River system, the High Aswan dam, and the Equatorial lake system. Improvements are predicted for energy output, enhancing the water supply and mitigating drought repercussions by use of this procedure. (4) In Situ Biological Treatment of Contaminated Groundwater, by F. M. Saunders. Permeameters were constructed and tested in this first year of a 2-year project to test in situ biological treatment of conproject to test in situ biological treatment of con-taminated groundwater on a laboratory scale. Soil contaminated with 2-4 dichlorophenol serves at the biological reactor and will be exposed to various oxidants and nutrient levels. (5) Geophysical Methods for Groundwater Location in Crystalline Rock of the Georgia Piedmont, by D. J. Spariosu. Ground resistivity measurements and electro-magorional resistivity measurements and electro-mag-netic methods were tested at three locations for finding water-filled fractures. Certain of the tech-niques appeared to benefit significantly the pro-specting process. (Kahn-GA Institute of Technology) W89-02553

FISCAL YEAR 1987 PROGRAM REPORT (NORTH CAROLINA WATER RESOURCES RESEARCH INSTITUTE).

North Carolina Water Resources Research Inst.,

North Carolina water Research
Raleigh.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB88-235759/
AS. Price codes: A03 in paper copy; A01 in microfiche. Program Report G1440-01, May 1988. 23p.
Contract No. 14-08-0001-G1440.

Descriptors: *Water Research Institute, *Research, *Information transfer, *Training, *North Carolina.

The major thrust of the Water Resources Research The major thrust of the Water Resources Research Institute during the 1987 program year involved activities related to its research and technology transfer program. Surface and groundwater quality and watershed protection problems are the top priority issues in the state. Research projects funded by the Institute to address these problems and issues included: the problem of developing better technology to document the specific sources of nitrogen in surface water experience nuisance. of nitrogen in surface water experiencing nuisance blue-green algal growth (02); the role of wetlands in removing nutrients from streams receiving wastewater discharges (03); the development and testing of a simulation model that can be used to analyze the performance of stormwater infiltration ponds in the coastal area (04); and the development and implementation of the Institute information materials, response to requests for information, development of conferences, workshops and semi-nars, publication of conference proceedings, and

the review and publication of research reports. (Lambert-UNC, WRRI) W89-02554

FISCAL YEAR 1986 PROGRAM REPORT (MASSACHUSETTS WATER RESOURCES RE-SEARCH CENTER),

Massachusetts Univ., Amherst. Water Resources Research Center.

P. J. Godfrey.

P. J. Godfrey.
Available from the National Technical Information Services, Springfield, VA 22161 as PB88-223515/
AS. Price codes: A04 in paper copy; A01 in microfiche. Annual Report No. G1231, September 1987.
60p. Contract No. 14-08-0001-G1231. Project No. USGS G1231-01.

Descriptors: *Water Research Institute, *Massachusetts, *Research projects, *Education, Training, *Information transfer, Research priorities.

The FY86 WRRC program focused on state and regional research priorities: acid deposition impacts and drinking water quality. WRIP supports and Wildlife, the Executive Office of Environmental Affairs, and the University of Massachusetts. Four WRIP projects were completed: Studies of natural mitigation of acid deposition via sulfate reduction in lakes, the effect of ozone and acid deposition on tree seedlings corresponding metals on reduction in lakes, the effect of ozone and acid deposition on tree seedlings, corrosion impacts on water quality, and creation of potentially hazardous chlorinated organics by drinking water treatment. The state Cooperative Aquatic Research Program funded 5 projects: Phase 3 of the Acid Rain Monitoring Project monitored by 800 water bodies quarterly and will continue its ten-year program. The role of acid deposition in enhancing lake sediments microgramisms which may ingram. The role of acid deposition in enhancing lake sediments microogranisms which may increase heavy metal methylation is under continuing investigation, as is control of aluminum mobility in watersheds and the effects of acid deposition on salamander communities. An Aquatic Toxicol ogy Program addressed research, training, and in-formation transfer for the Massachusetts Division formation transier for the Massachusetts Division of Fisheries and Wildlife. Other information transfer included a monthly water resources center newsletter, a quarterly Actid Rain Monitoring Project newsletter, and acid rain reports to the media and general public. (Cole-MA Univ.) W89-02587

FISCAL YEAR 1986 PROGRAM REPORT (VIRGIN ISLANDS WATER RESOURCES RE-SEARCH CENTER), Caribbean Research Inst., St. Thomas, VI. Water Resources Research Center.

Available from the National Technical Information Services, Springfield, VA 22161 as PB88-223508/ AS. Price codes A03 in paper copy; A01 in micro-fiche. Program Report, August 1987. 25p, append.

Descriptors: *U.S. Virgin Islands, *Research, *Education, *Water Research Institute, Training, Information transfer, Projects.

The maintenance of cistern water quality is outlined in the project 'Maintenance of Cistern Water Quality and Quantity in the United States Virgin Islands.' The pathways through which cisterns become contaminated were determined and methods to reduce contamination were proposed. The quality of groundwater which may be safely extracted from the Kingshill aquifer in St. Croix is discussed in the project 'Subsurface Geology of the St. Croix Carbonate Rock System: Phase III.' In its effort to disseminate information on the various its effort to disseminate information on the various its effort to disseminate information on the various activities, the Water Center prepared a video tape on hydrology based on Information Bulletin Number 2, 'A General Overview of Hydrology and the Analysis of Rainfall Data.' Two seminars and the Analysis of Kaintali Data. I wo seminara were conducted on 'Introduction to Environmental Microbiology.' In the area of training and development, three students were hired to assist with the project 'Maintenance of Cistern Water Quality'. and Quantity in the United States Virgin Islands.' A fourth student was hired to assist in the general activities of the center. (USGS)

SCIENTIFIC AND TECHNICAL INFORMATION—Field 10

Preparation Of Reviews—Group 10F

HYDROLOGY AND HYDROLOGISTS, Manchester Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2A. W89-02727

10. SCIENTIFIC AND TECHNICAL INFORMATION

10B. Reference and Retrieval

DESALINATION OF WATER. CITATIONS FROM THE COMPENDEX ENGINEERING INFORMATION, INC. DATABASE (DEC 83 - SEP

National Technical Information Service, Spring-

For primary bibliographic entry see Field 3A. W89-02782

DREDGING: TECHNOLOGY AND ENVIRON-MENTAL ASPECTS. CITATIONS FROM THE LIFE SCIENCES COLLECTION DATABASE (JAN 78 - AUG 87). National Technical Information Service, Spring-field VA

For primary bibliographic entry see Field 2J. W89-02783

ACID PRECIPITATION, CITATIONS FROM THE COMPENDEX ENGINEERING INFOR-MATION INC, DATABASE (SEPT 84 - AUG 86), National Technical Information Service, Spring-

For primary bibliographic entry see Field 5B. W89-02784

ACID PRECIPITATION. CITATIONS FROM THE COMPENDEX ENGINEERING INFOR-MATION INC. DATABASE (SEPT 86 - AUG 87). National Technical Information Service, Spring-field, VA.

For primary bibliographic entry see Field 5B. W89-02785

WASTEWATER TREATMENT: OZONATION PROCESSES AND EQUIPMENT, CITATIONS FROM THE SELECTED WATER RESOURCES ABSTRACTS DATABASE (JAN 77 - AUG SIN National Technical Information Service, Spring-

For primary bibliographic entry see Field 5D. W89-02786

10C. Secondary Publication And Distribution

SELECTED LITERATURE ON WATER RE-SOURCES INVESTIGATIONS IN NEW JERSEY BY THE U.S. GEOLOGICAL SURVEY, THROUGH 1986.

Geological Survey, Trenton, NJ. Water Resources

Div. F. L. Schaefer. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-767, 1987.

Descriptors: *Bibliographies, *Maps, *Publica-tions, *New Jersey, Water resources, Hydrology, Literature, Reports, Water quality, Surface water, Groundwater, Floods, Drought, Geology, Water supply, Computer models, Land use, Aquifers, Rivers, Sediments.

Because of the importance and complexity of the water resources of New Jersey today, there is a

need for a current bibliography to serve as a basis for future, water resources studies. This report lists about 400 book reports, map reports, and articles that deal with the water resources of New Jersey published through 1986. The publications are grouped under three major headings: (1) publications of State agencies prepared by or in cooperation with the U.S. Geological Survey; and (3) other publications, such as technical journals prepared by or co-authored by U.S. Geological Survey personnel. Most of the publications are available for inspection at the West Trenton office of the U.S. Geological Survey and at large public and university libraries. Ordering information is given for those publications that are for sale. (USGS) W89-02466

WATER RESOURCES PUBLICATIONS OF THE U.S. GEOLOGICAL SURVEY, FOR TEN-NESSEE, 1906-1987,

Geological Survey, Nashville, TN. Water Resources Div.

Sources Div.

E. G. Baker, and R. C. Massingill.

Available from OFSS, USGS, Box 25425, Denver,

CO 80225. USGS Open-File Report 87-552, 1988.

Descriptors: *Tennessee, *Bibliographies, *Litera-ture, *Publications, Hydrologic data collections, Data collections, Surface water, Groundwater, Floods, Low flow, Water quality.

A bibliography of publications has been compiled of the water resources investigations published by the U.S. Geological Survey, Water Resources Division, in Tennessee. The bibliography includes an alphabetical listing by author, as well as listings by general and specific areas in Tennessee. The publications are classified also by discipline and type of report: open-file reports, water supply papers, water resources investigations, professional papers, circulars, hydrologic investigations atlases, miscellaneous investigations maps, journal and symposium articles, water resources bulletin articles, and water resources data reports. (USGS) W89-02467

PROCEEDINGS, SEVENTEENTH MISSISSIP-PI WATER RESOURCES CONFERENCE, 25-26 MARCH, 1987, JACKSON, MISSISSIPPI. Mississippi State Univ., Mississippi State. Water Resources Research Inst. For primary bibliographic entry see Field 6B. W89-02476

BIBLIOGRAPHY OF U.S. GEOLOGICAL SURVEY REPORTS ON THE WATER RE-SOURCES OF FLORIDA, 1886-1984, Geological Survey, Tallahassee, FL. Water Resources Div.

M. Claiborne, T. D. Wilson, and N. D. Hoy. Available from OFSS, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-424, 1987. 172p, 1 fig.

Descriptors: *Bibliographies, *U.S. Geological Survey, *Florida, *Water resources reports, Hydrologic data.

The U.S. Geological Survey has released a listing of its report on water resources in Florida for the period 1886-1984. Most of the reports contained in the listing were prepared by the U.S. Geological Survey in cooperation with numerous public agencies in Florida. The compilation has a full bibliographic list of reports arranged alphabetically by senior author. In addition, the reports are indexed by geographic areas and by subject. (USGS) W89-02527

RECENT ADVANCES IN MAGNETIC PROC-

Lenox Inst. for Research, Inc., MA. For primary bibliographic entry see Field 5D. W89-02961

EMISSIONS AND CONTROL OF OFFENSIVE ODOR IN WASTEWATER TREATMENT ODOR IN PLANTS.

Lenox Inst. for Research, Inc., MA.
For primary bibliographic entry see Field 5D.
W89-02962

10D. Specialized Information Center Services

DEVELOPMENT, MANAGEMENT, AND ANALYSIS OF A LONG-TERM ECOLOGICAL RESEARCH INFORMATION BASE: EXAMPLE FOR MARINE MACROBENTHOS, South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research. W. K. Michener, R. J. Feller, and D. G. Edwards. IN: New Approaches to Monitoring Aquatic Ecosystems. American Society for Testing and Materials, Philadelphia, PA. 1987. p 173-188, 3 fig. 3 tab, 11 ref. National Science Foundation Grant BSR-8012165.

Descriptors: *Information systems, *Data storage and retrieval, *Monitoring, *Water quality, *Data collection, *Ecosystems, Management planning, Statistical analysis, Temporal variation, Long-term Ecological Research Program, Design criteria, Re-

search support.

As one of eleven Long-Term Ecological Research Program sites in the nation (designated by the National Science Foundation), the Belle W. Baruch Institute for Marine Biology and Coastal Research has developed a flexible system for the Baruch Data Management System (BDMS) contains over four years of data collected from ecological research on coastal and estuarine habitats. Important design features of information bases for long-term monitoring are described. Since temporal variability is an inherent part of ecological data sets, it is important to delineate those periods when sampling must be intensified and periods when sampling can be decreased without compromising documentation of the processes under question. Examples of analyses of temporal variability for one of the biological data sets (macrobenthos) are presented, and a case is made for the importance of long-term monitoring effects to the generations of process-related experiments. (See also W89-02317) (Author's abstract)

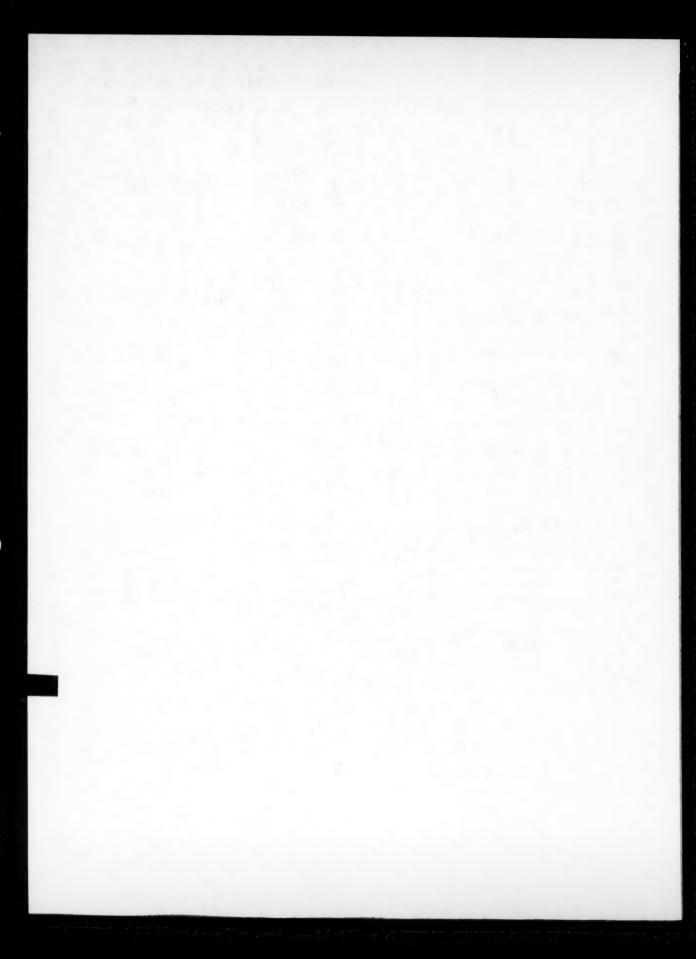
NOAA SATELLITE-DERIVED SNOW COVER DATA BASE: PAST, PRESENT, AND FUTURE, National Environmental Satellite, Data, and Information Service, Washington, DC.
For primary bibliographic entry see Field 2C.
W89-02617

10F. Preparation Of Reviews

NITRATES AND PESTICIDES IN GROUND WATER: AN ANALYSIS OF A COMPUTER-BASED LITERATURE SEARCH,

Oklahoma Univ., Norman. Environ Ground Water Inst.

For primary bibliographic entry see Field 5B. W89-02666



SUBJECT INDEX

ACCLIMATIZATION Role of Protozoa in Microbial Acclimation for Mineralization of Organic Chemicals in Sewage,	National Surface Water Survey, Western Lake Survey (Phase I Synoptic Chemistry) Quality Assurance Plan,	Acid Precipitation in North America: 1985 Annual and Seasonal Data Summaries from Acid Deposition System Data Base,
W89-03283 5D	W89-02413 2H	W89-02997 5B
ACCLIMITIZATION Physiological Evidence of Acclimation to Acid/ Aluminum Stress in Adult Brook Trout (Salvelinus fontinalis): II. Blood Parameters by Cannu-	External Quality-Assurance Results for the National Atmospheric Deposition Program and National Trends Network During 1986, W89-02463 7C	Effects of Ozone and Acid Rain on White Pine (Pinus strobus) Seedlings Grown in Five Soils: II. Mycorrhizal Infection, W89-03057 5C
lation,		Effects of Occasional Ania Rain on White River
W89-03238 5C ACID MINE DRAINAGE	Directory of Precipitation Monitoring Sites, Na- tional Atmospheric Deposition Program/Na- tional Trends Network (NADP/NTN).	Effects of Ozone and Acid Rain on White Pine (Pinus strobus) Seedlings Grown in Five Soils: III. Nutrient Relations,
Hydrogeologic and Geochemical Aspects of Contaminant Transport at the Falls City, Texas UMTRA Site,	W89-02480 7A	W89-03058 5C Sensitivity of Meander Lake to Acid Deposition,
W89-02362 5B	Results of Intercomparison Studies for the Meas- urements of pH and Specific Conductance at	W89-03110 5C
Effects of Acid Mine Drainage on Groundwater Quality at the Leviathan Sulfur Mine, Alpine	National Atmospheric Deposition Program/Na- tional Trends Network Monitoring Sites, Octo-	Fate of Added Alkalinity During Neutralization of Acid Lake,
County, California, W89-02363 5C	ber 1981-October 1985, W89-02485 5A	W89-03111 5G
		Reversibility of Acidification Shown by Whole-
ACID MINE WATER Migration of Acidic Groundwater Seepage from Uranium-Tailings Impoundments: 2. Geochemi-	Evaluation of Rain Chemistry Data for the John F. Kennedy Space Center, Florida and the University of Central Florida, Orlando, Florida,	Catchment Experiments, W89-03120 5B
cal Behavior of Radionuclides in Groundwater, W89-03038	W89-02708 4C	Contaminated Aquifers are a Forgotten Compo- nent of the Global N2O Budget,
Migration of Acidic Groundwater Seepage from	Acidification of Freshwaters,	W89-03121 5B
Uranium-Tailings Impoundments: 3. Simulations	W89-02774 5B	Recent Acidification of a Large Scottish Loch
of the Conceptual Model with Application to Seepage Area A, W89-03039 5B	Acid Precipitation. Citations from the COM- PENDEX Engineering Information Inc. Data- base (Sept 84 - Aug 86).	Located Partly within a National Nature Re- serve and Site of Special Scientific Interest, W89-03125 5C
	W89-02784 5B	
ACID RAIN Effects of Atmospheric Pollutants on Forests,	Acid Precipitation. Citations from the COM-	Effects of Simulated Acid Rain on Sugar Maple Seedling Root Growth,
Wetlands and Agricultural Ecosystems. W89-02304 5B	PENDEX Engineering Information Inc. Data- base (Sept 86 - Aug 87).	W89-03300 5C
Consequences of Cloud Water Deposition on	W89-02785 5B	ACID RAIN EFFECTS Thermodynamic Calculations with Special Ref-
Vegetation at High Elevation, W89-02305 5B	Acid Precipitation Literature Review 1986: Emission, Transport, Transformation and Depo-	erence to the Aqueous Aluminum System, W89-02641 2K
Air Pollution and Soil Acidification, W89-02306 5B	sition of Acidic Trace Species, W89-02822 5B	Transport, Bioaccumulation, and Toxicity of Metals and Metalloids in Microorganisms under
Discussion of the Changes in Soil Acidity Due	Review of Papers Published in 1985 about Emis-	Environmental Stress,
to Natural Processes and Acid Deposition, W89-02307 5B	sion, Transport, Transformation and Deposition of Atmospheric Trace Constituents of Impor-	W89-02652 5E Western Lake Survey, Phase I. Data Base.
Soil Acidification and Metal Solubility in For-	tance for Acid Deposition, W89-02827 , 5B	W89-02946 2F
ests of Southern Sweden, W89-02308 5B		Critique of Models for Freshwater and Soi
	Summary of Maryland Stream pH and Alkalini- ty Data: Analysis of Its Application to Assessing	Acidification, W89-02967 51
Differences in Aluminum Mobilization in Spodo- sols in New Hampshire (USA) and in the Neth-	the Impacts of Acidic Deposition, W89-02840 5C	Aquatic Macrophytes in Adirondack (New
erlands as a Result of Acid Deposition, W89-02309 5B	Fiscal Year 1985 Summary Report of NOAA	York) Lakes: Patterns of Species Composition in Relation to Environment,
Limits on Cation Leaching of Weakly Podzo-	Meteorology Division Support to the Environ- mental Protection Agency.	W89-03056 50
lized Forest Soils: An Empirical Evaluation, W89-02310 5B	W89-02857 5B	Atmospheric, Geological, Marine, and Anthro pogenic Effects on Groundwater Quality in Fin
Natural and Anthropogenic Acidification of Peatlands,	Studies of the Mechanisms and Rates with which Nitrogen Species are Incorporated into	land, W89-03076 51
W89-02311 5B	Cloud Water and Precipitation, W89-02862 5B	Effect of pH on Speciation and Toxicity of
Responses to Acidic Deposition in Ombotrophic Mires in the U.K.,	Survey of Sensitivity of Southern California	Aluminum to Rainbow Trout (Salmo gairdneri W89-03213
W89-02314 5B	Lakes to Acid Deposition,	Effects of Liming on the Distribution of Cadm
Stratigraphic Record of Atmospheric Loading of Metals at the Ombrotrophic Big Heath Bog,	W89-02864 5C	um in Water, Sediment, and Organisms in Swedish Lake,
Mt. Desert Island, Maine, U.S.A., W89-02315 5B	National Acid Precipitation Assessment Program: Annual Report, 1986.	W89-03224 5
Proton Cycling in Bogs: Geographical Variation	W89-02873 5B	Long-Term Sublethal Acid Exposure in Rain bow Trout (Salmo gairdneri) in Soft Wate
in Northeastern North America, W89-02316 5B	NAPAP Operating Research Plan: 1986-1988. W89-02876 5B	Effects on Ion Exchanges and Blood Chemistry W89-03226
Comparison of Lake Sediments and Ombrotro-	Development and Field Use of a Snow Collec-	Scaled Chrysophytes (Chrysophyceae) as Ind
phic Peat Deposits as Long-Term Monitors of Atmospheric Pollution,	tor for Acid Precipitation Studies, W89-02945 5B	cators of pH in Sudbury, Ontario, Lakes, W89-03227 5.
W89-02321 5A	Rocky Mountain Acid Deposition Model As-	Effects of Aluminum and Low pH on Net Io
Modeling the Response of Lake-Aquifer Sys-	sessment: Evaluation of Mesoscale Acid Deposi-	Fluxes and Ion Balance in the Brook Tro
tems to Acid Precipitation, W89-02341 5C	tion Models for Use in Complex Terrain, W89-02969 5B	(Salvelinus fontinalis), W89-03235

ACID RAIN EFFECTS

Blood Gases, Acid-Base Status, Ions, and Hema- tology in Adult Brook Trout (Salvelinus fontina- lis) Under Acid/Aluminum Exposure, W89-03236 5C	Physiological Evidence of Acclimation to Acid/ Aluminum Stress in Adult Brook Trout (Salve- linus fontinalis): I. Blood Composition and Net Sodium Fluxes,	Interactions of Organic Matter and Aluminum Ions in Acid Forest Soil Solutions: Metal Com- plexation, Flocculation, and Precipitation, W89-03126 2K
	W89-03237 5C	110703120
Physiological Evidence of Acclimation to Acid/ Aluminum Stress in Adult Brook Trout (Salve-	Physiological Evidence of Acclimation to Acid/	Effect of pH on Iron and Manganese Uptake by a Green Alga,
linus fontinalis): I. Blood Composition and Net Sodium Fluxes,	Aluminum Stress in Adult Brook Trout (Salve- linus fontinalis): II. Blood Parameters by Cannu-	W89-03246 5C
W89-03237 5C	lation,	ACTIVATED CARBON
Physiological Evidence of Acclimation to Acid/ Aluminum Stress in Adult Brook Trout (Salve-	W89-03238 5C Sodium Transport in the Brook Trout, Salve-	Experiences with Granular Activated Carbon Filtration and On-Site Reactivation at Jefferson
linus fontinalis): II. Blood Parameters by Cannulation,	linus fontinalis: Effects of Prolonged Low pH Exposure in the Presence and Absence of Alu-	Parish, Louisiana, W89-02790 5F
W89-03238 5C	minum, W89-03239 5C	Treatment of Hazardous Wastes in a Sequencing
Sodium Transport in the Brook Trout, Salve-		Batch Reactor,
linus fontinalis: Effects of Prolonged Low pH Exposure in the Presence and Absence of Alu-	Effects of Low pH and Aluminum on Ventila- tion in the Brook Trout (Salvelinus fontinalis),	W89-02917 5D
minum, W89-03239 5C	W89-03240 5C Effect of Long-Term Exposure to Acid, Alumi-	Biodegradation of Recalcitrant Industrial Wastes,
Effects of Low pH and Aluminum on Ventila-	num, and Low Calcium on Adult Brook Trout	W89-02926 5D
tion in the Brook Trout (Salvelinus fontinalis), W89-03240 5C	(Salvelinus fontinalis): I. Survival, Growth, Fecundity, and Progeny Survival,	Offline Bioregeneration of Granular Activated Carbon,
Effect of Long-Term Exposure to Acid, Alumi- num, and Low Calcium on Adult Brook Trout	W89-03241 5C Effect of Long-Term Exposure to Acid, Alumi-	W89-03103 5D
(Salvelinus fontinalis): I. Survival, Growth, Fecundity, and Progeny Survival,	num, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Os-	ACTIVATED SLUDGE Reuse of Chemical Sludge for Conditioning of
W89-03241 5C	moregulation,	Biological Sludges,
Effect of Long-Term Exposure to Acid, Alumi-	W89-03242 5C	W89-02815 5D
num, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Os-	Morphometric Changes in Gill Secondary La- mellae of Brook Trout (Salvelinus fontinalis)	Enhanced Biological Phosphorus Removal from Waste Waters,
moregulation,	after Long-Term Exposure to Acid and Alumi-	W89-02931 5D
W89-03242 5C	num, W89-03243 5C	Effect of Activated Sludge in the Breeder Diet
Morphometric Changes in Gill Secondary La- mellae of Brook Trout (Salvelinus fontinalis)	Effect of pH on Iron and Manganese Uptake by	on the Reproduction Criteria and the Perform-
after Long-Term Exposure to Acid and Alumi-	a Green Alga,	ance of their Offspring, W89-03061 5E
num, W89-03243 5C	W89-03246 5C	
	ACIDIFICATION Interactions of Sphagnum with Water and Air.	Toxicity of Selected RCRA Compounds to Ac- tivated Sludge Microorganisms,
Effect of pH on Iron and Manganese Uptake by a Green Alga,	W89-02312 2H	W89-03165 5D
W89-03246 5C	Sources of Alkalinity in Precambrian Shield Wa-	Evaluation of Sludge Settleability be Floc Char-
Effects of Simulated Acid Rain on Sugar Maple	tersheds Under Natural Conditions and After	acteristics,
Seedling Root Growth, W89-03300 5C	Fire or Acidification, W89-02313 2G	W89-03167 5D
		ACTIVATED SLUDGE PROCESS
ACID TREATMENT Heavy Metal Removal from Sewage Sludge:	Acidification of Freshwaters, W89-02774 5B	Fate of Water Soluble Azo Dyes in the Activat-
Practical Experiences with Acid Treatment,		ed Sludge Process, W89-02935 5D
W89-02818 5D	Acid Precipitation. Citations from the COM- PENDEX Engineering Information Inc. Data-	Pilot-Plant Evaluations of Porous Biomass Sup-
ACIDIC WATER	base (Sept 84 - Aug 86).	ports,
Natural and Anthropogenic Acidification of Peatlands,	W89-02784 5B	W89-03104 5D
W89-02311 5B	Acid Precipitation. Citations from the COM- PENDEX Engineering Information Inc. Data-	Unit Process Tradeoffs for Combined Trickling
Modeling Acid Migration Through Soils, W89-02361 5B	base (Sept 86 - Aug 87). W89-02785 5B	Filter and Activated Sludge Processes, W89-03160 5D
Aquatic Macrophytes in Adirondack (New	Maryland Synoptic Stream Chemistry Survey:	ACTIVATED SLUDGE PROCESSES
York) Lakes: Patterns of Species Composition in Relation to Environment,	Estimating the Number and Distribution of Streams Affected By or At Risk from Acidifica-	Fate of 4,6-Dinitro-o-Cresol in Municipal Activated Sludge Systems,
W89-03056 5C	tion,	W89-02296 5D
Fate of Added Alkalinity During Neutralization	W89-02846 5B	Anoxic/Oxic Activated Sludge Treatment of
of Acid Lake, W89-03111 5G	Critique of Models for Freshwater and Soil Acidification,	Cyanogens and Ammonia in the Presence of Phenols.
Scaled Chrysophytes (Chrysophyceae) as Indi-	W89-02967 5B	W89-02298 5D
cators of pH in Sudbury, Ontario, Lakes, W89-03227 5A	Aquatic Macrophytes in Adirondack (New York) Lakes: Patterns of Species Composition in	ADIRONDACK MOUNTAINS
Effects of Aluminum and Low pH on Net Ion	Relation to Environment,	Aquatic Macrophytes in Adirondack (New
Fluxes and Ion Balance in the Brook Trout	W89-03056 5C	York) Lakes: Patterns of Species Composition in Relation to Environment,
(Salvelinus fontinalis), W89-03235 5C	Acidification and Succession in a Flood-Plain Mire in the Norfolk Broadland, U.K.,	W89-03056 50
Blood Gases, Acid-Base Status, Ions, and Hema-	W89-03123 2H	ADMINISTRATIVE AGENCIES
tology in Adult Brook Trout (Salvelinus fontina-	ACIDITY	U.S.D.A. Agricultural Research Service Com
lis) Under Acid/Aluminum Exposure, W89-03236 5C	Acidification of Freshwaters, W89-02774 5B	mitment to Ground Water Research, W89-02655 31

DOORDELON	ACRECH MIN IT CHINATOLE	1
DSORPTION	AGRICULTURAL CHEMICALS	Investigation of Nitrate Contamination in Shal-
Use of Rapid Small-Scale Column Tests to Pre-	In Situ Aquifer Denitrification: Remediation of	low Ground Waters Near Woodward, Oklaho-
dict Full-Scale Adsorption Capacity and Per-	Ammonia and Nitrate Contaminated Subsurface	ma,
formance, W89-02789 5F	Environments, W89-02359 5G	W89-02671 5B
W89-02/89 3F	W89-02359 5G	Regulation of the Agricultural Utilization of
Modeling the Effects of Adsorbed Hydrolyzed	Quality of Groundwater in Shallow Wells in	Sewage Sludge in New Jersey,
Al(III)-Ions on Deep Bed Filtration,	Agricultural Areas of Haywood, Shelby, Lake,	W89-02676 5E
W89-02796 5F	and Obion Counties, Tennessee, January-Febru-	
	ary 1988,	Nitrogen and Ground Water Protection.
Reuse of Chemical Sludge for Conditioning of	W89-02557 5B	W89-02679 5G
Biological Sludges,		
W89-02815 5D	Behavior And Subsurface Transport of Agro-	Ground Water and Agriculture: Addressing the
Economic Evaluation of Carbon Adsorption/	chemicals in Conservation Systems,	Information Needs of Pennsylvania's Chesa-
Ion Exchange Wastewater Treatment Options	W89-02667 5B	peake Bay Program, W89-02680 5G
for Sunflower AAP NQ Wastewater Treatment	Impacts of Agricultural Chemicals on Ground	W89-02680 5G
Facility.	Water Quality in Iowa,	Developing a State Ground Water Policy in the
W89-02828 5D	W89-02668 5B	Corn Belt: the Iowa Case.
	W 87-02008 3B	W89-02681 2F
Sensitivity Analysis of Adsorption and Degrada-	Assessment of Empirical Methodologies for Pre-	
tion Parameters in the Modeling of Pesticide	dicting Ground Water Pollution from Agricul-	Lake Erie Conservation Tillage Demonstration
Transport in Soils,	tural Chemicals,	Projects: Evaluating Management of Pesticides,
W89-03150 2G	W89-02670 5B	Fertilizer, Residue to Improve Water Quality.
Manager of Carbafrana (Namaticida) in Sail		W89-02837 3F
Movement of Carbofuran (Nematicide) in Soil Columns,	Incentives and Institutions to Reduce Pesticide	A ID CIDCUT ATTOM
W89-03297 5B	Contamination of Ground Water,	AIR CIRCULATION
W 89-03291 3.B	W89-02677 5G	Relationship of Surface Pressure Features to the
Degradation of Bromoform and Chlorodibromo-	ACDICULTUDAL DINOFF	Precipitation and Airflow Structure of an In-
methane in a Catalyzed H2-Water System,	AGRICULTURAL RUNOFF	tense Midlatitude Squall Line,
W89-03311 2K	Analysis of Agricultural Nonpoint Pollution	W89-03274 2B
	Control Options in the St. Albans Bay Water-	AIR DEMAND
Treatment of Potable Water from Seoul, Korea	shed,	Air Demand and Conduit Pressures, Stillhouse
by Flotation, Filtration and Adsorption,	W89-02419 5G	Hollow Dam, Lampasas River, Texas,
W89-03319 5F	Agricultural Impact on Groundwater Quality,	W89-02415 8B
	W89-02549 5B	W 69-02413
ADVECTION	W 07-02349	AIR-EARTH INTERFACE
Modeling Acid Migration Through Soils,	Managing Farm Nutrients: Tradeoffs for Sur-	Influence of Potential Evaporation on the Varia-
W89-02361 5B	face- and Ground-Water Quality,	bilities of Simulated Soil Wetness and Climate,
Lagrangian-Eulerian Approach to Modeling	*****	W89-03308 2D
Hydrogeochemical Transport of Multi-Compo-		
nent Systems,	AGRICULTURE	AIR ENTRAINMENT
W89-03320 5B	Ground Water Quality and Agricultural Prac-	Air Demand and Conduit Pressures, Stillhouse
	tices.	Hollow Dam, Lampasas River, Texas,
AERATION	W89-02654 3F	W89-02415 8B
Effects of Aeration and Minimum Flow En-		AIR POLLUTION
hancement on the Biota of Norris Tailwater,	mitment to Ground Water Barersh	Effects of Atmospheric Pollutants on Forests,
W89-02826 5G	W89-02655 3F	Wetlands and Agricultural Ecosystems.
Computer Aided Design of Diffused Aeration		W89-02304 5B
Systems,	Ground Water Contamination from Saltwater	W 67-02304
W89-02947 5D	Intrusion And Limitations on Agricultural Ac-	Consequences of Cloud Water Deposition on
1107-02547	tivities,	Vegetation at High Elevation,
Control of Volatile Organic Contaminants in	W89-02662 5B	W89-02305 5E
Groundwater by In-Well Aeration,		
W89-02955 5F		Air Pollution and Soil Acidification,
	Municipal Sewage Effluent for Agricultural	W89-02306 5E
Temperature Dependence of Liquid Film Coef-		Comparison of Lake Sediments and Ombrotro
ficient for Gas Transfer,	W89-02663 5E	phic Peat Deposits as Long-Term Monitors of
W89-03112 2K	Efficient Nitrogen Fertilization in Agricultural	Atmospheric Pollution,
AERATION ZONE	Production Systems,	W89-02321 5A
Role of Tracer Data for Modeling Soil-Water		W 05-02321
Flow in the Unsaturated Zone,		Design of a Great Lakes Atmospheric Input
W89-03013 2C	Nitrates and Pesticides in Ground Water: An	and Sources (GLAIS) Network,
	Analysis of a Computer-Based Literature	W89-02418 7A
AERIAL PHOTOGRAPHY	Search,	
Remote Sensing,	W89-02666 5B	Review of Papers Published in 1985 about Emis
W89-02761 7I		sion, Transport, Transformation and Deposition
A PROPER PARAMETERS	Behavior And Subsurface Transport of Agro-	of Atmospheric Trace Constituents of Impor
AEROBIC DIGESTION	chemicals in Conservation Systems,	tance for Acid Deposition,
Role of Phenolic and Humic Compounds in	W89-02667 5B	W89-02827 51
Anaerobic Digestion Processes, W89-02924 5I	Impacts of Agricultural Chemicals on Ground	Fiscal Year 1985 Summary Report of NOAA
W 07-02724 31	Water Quality in Iowa,	Meteorology Division Support to the Environ
Comparison Between Waste Water Treatment i	W89-02668 5B	mental Protection Agency.
Completely Mixed and Fluidized Bed Reactors		W89-02857 51
Development and Structure of Biomass (Verg		
leich der Absasserreinigung im Ruhr - und ir	nomic Practices and Improving Ground Water	Studies of the Mechanisms and Rates wit
Wirbelbettreaktor Sowie Entwicklung un		which Nitrogen Species are Incorporated int
Struktur der Biomasse),	W89-02669 5G	Cloud Water and Precipitation,
W89-03045 5I		W89-02862 5
	Assessment of Empirical Methodologies for Pre-	
AEROBIC TREATMENT	dicting Ground Water Pollution from Agricul-	Contaminated Aquifers are a Forgotten Compo
Biotreatment Systems: Volume I.	tural Chemicals,	nent of the Global N2O Budget,
W89-02914 51	W89-02670 5B	W89-03121 5

SUBJECT INDEX

AIR POLLUTION

Recent Acidification of a Large Scottish Loch Located Partly within a National Nature Re-	Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama;	ALGAE Phytokarst, Blue-green Algae and Limestone
serve and Site of Special Scientific Interest, W89-03125 5C	Area 8, W89-02564 5B	Weathering, W89-02732 2K
Asbestos-Contaminated Drinking Water: Its Impact on Household Air,	Geohydrology and Susceptibility of Coldwater Spring and Jacksonville Fault Areas to Surface	Effect of Assam Crude on Photosynthesis and Associated Electron Transport System in Ana-
W89-03299 5B	Contamination in Calhoun County, Alabama, W89-02576 5B	baena doliolum, W89-03207 5C
AIR POLLUTION EFFECTS	Geohydrology and Susceptibility of Major	
Effects of Atmospheric Pollutants on Forests, Wetlands and Agricultural Ecosystems.	Aquifers to Surface Contamination in Alabama,	Effect of pH on Iron and Manganese Uptake by
W89-02304 5B	Area 7, W89-02577 5B	a Green Alga, W89-03246 5C
Responses to Acidic Deposition in Ombotrophic		District Control College
Mires in the U.K.,	Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama,	Phosphorous Flux from Lake Sediments: Effect of Epipelic Algal Oxygen Production,
W89-02314 5B	Area 1,	W89-03248 2H
Stratigraphic Record of Atmospheric Loading	W89-02578 5B	Phototrophic Picoplankton: An Overview from
of Metals at the Ombrotrophic Big Heath Bog,	Geohydrology and Susceptibility of Major	Marine and Freshwater Ecosystems,
Mt. Desert Island, Maine, U.S.A., W89-02315 5B	Aquifers to Surface Contamination in Alabama, Area 6,	W89-03259 2H
	W89-02590 5B	Prediction of Reservoir Phytoplankton Condi-
CO2-Induced Changes in Seasonal Snow Cover Simulated by the OSU Coupled Atmospheric-	North Alabama Water Quality Assessment,	tion by the Fluorescence Method, W89-03291 2H
Ocean General Circulation Model,	Volume VIII - Water Quality Modeling,	W 89-03291 2H
W89-02629 2C	W89-02702 5B	ALGAL BLOOMS
Acidification of Freshwaters,	Summary of the Hydrology of the Floridan Aq-	Effects of the Blue-Green Alga Microcystis Aer- uginosa on Zooplankton Competitive Relations,
W89-02774 5B	uifer System in Florida and in Parts of Georgia, South Carolina, and Alabama,	W89-03118 2H
Acid Precipitation. Citations from the COM-	W89-03034 2F	Temporal Variations in Dissolved and Particu-
PENDEX Engineering Information Inc. Data-	ALASKA	late Aluminum During a Spring Bloom,
base (Sept 84 - Aug 86). W89-02784 5B	Design Problems in Gravel-Bed Rivers, Alaska,	W89-03192 2L
	W89-02458 2J	ALIPHATIC HYDROCARBONS
National Acid Precipitation Assessment Pro- gram: Annual Report, 1986.	Map Showing Groundwater Levels in Anchor-	Literature Study on the Feasibility of Microbio-
W89-02873 5B	age, Alaska, 1985, W89-02526 7C	logical Decontamination of Polluted Soils, W89-02916 5G
Effects of Ozone and Acid Rain on White Pine		
(Pinus strobus) Seedlings Grown in Five Soils:	Hydrologic Reconnaissance of the Chilkat River Basin, Southeast Alaska (with Special Reference	ALKALINITY Sources of Alkalinity in Precambrian Shield Wa-
II. Mycorrhizal Infection, W89-03057 5C	to the Bald Eagle Critical Habitat at the Tsirku	tersheds Under Natural Conditions and After
	River Alluvial Fan),	Fire or Acidification,
Potential Impacts of a Scenario of CO2-Induced Climatic Change on Ontario, Canada,	W89-02565 2E	W89-02313 2G
W89-03063 2A	Surface Topography of the Lower Part of Co- lumbia Glacier, Alaska, 1974-81,	Alkalinity Measurements in Karst Water Stud-
Response of Coastal Plants to Increase in Sub-	W89-03021 2C	ies, W89-02729 2F
mergence and Salinity,	Bed Topography Inferred From Airborne	7,77
W89-03188 2L	Radio-Echo Sounding of Columbia Glacier,	Summary of Maryland Stream pH and Alkalini- ty Data: Analysis of Its Application to Assessing
AIR STRIPPING	Alaska,	the Impacts of Acidic Deposition,
Economic Evaluation of Air Stripping to	W89-03022 2C	W89-02840 5C
Remove Volatile Organic Compounds from Water,	ALBEDO	Fate of Added Alkalinity During Neutralization
W89-02976 5F	Numerical Model for the Computation of Radi- ance Distributions in Natural Waters with Wind-	of Acid Lake,
AIR-STRIPPING TOWERS	Roughened Surfaces, Part II: User's Guide and	W89-03111 5G
Water System Responses to Toxic Contamina-	Code Listing, W89-02414 2H	Influence of Na and Ca Alkalinity on UASB
tion of Groundwater Supplies,		Treatment of Olive Mill Effluents: I. Preliminary Results,
W89-02586 5F	Progression of Regional Snow Melt, W89-02610 2C	W89-03116 5D
AIR-WATER INTERFACES		
Asbestos-Contaminated Drinking Water: Its Impact on Household Air,	Soot from Arctic Haze: Radiative Effects on the Arctic Snowpack,	ALLUVIAL AQUIFER Construction, Geologic, and Hydrologic Data
W89-03299 5B	W89-02611 2C	for Observation Wells in the Reelfoot Lake
AIRCRAFT	Remote Sensing of Snow Properties in Moun-	Area, Tennessee and Kentucky, W89-02510 7B
Diagnostic Technique for Targeting during Air-	tainous Terrain,	
borne Seeding Experiments in Wintertime Storms over the Sierra Nevada,	W89-02624 7B	ALLUVIAL AQUIFERS
W89-03305 2B	Parameterization of Snow Albedo for Climate Models,	Groundwater Levels in the Alluvial Aquifer in Eastern Arkansas, 1986,
AIRPORT WASTES	W89-02626 7C	W89-02522 2F
Alternative Treatment of De-Icing Fluids from	ALBERTA	Hydrologic Analysis of the Rio Grande Basin
Airports,	Natural Flow and Water Consumption in the	North of Embudo, New Mexico, Colorado and
W89-02807 5D	Milk River Basin, Montana and Alberta, Canada,	New Mexico, W89-02589 2F
ALABAMA	W89-03004 2E	
Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama;	ALCOHOLS	Seasonal Changes in Groundwater Levels in the
Area 9,	Alternative Treatment of De-Icing Fluids from Airports,	Shallow Aquifers Near Hagerman and the Pecos River, Chaves County, New Mexico,
W89-02563 5B	W89-02807 5D	W89-02601 4F

Role of Riparian Woods in Regulating Nitrogen Fluxes Between the Alluvial Aquifer and Sur-	Interaction of Bed Load Transport with Bars, W89-02456 2J	Effects of Aluminum and Low pH on Net Ion Fluxes and Ion Balance in the Brook Trout
face Water: A Conceptual Model, W89-03140 6G	Design Problems in Gravel-Bed Rivers, Alaska,	(Salvelinus fontinalis), W89-03235 5C
	W89-02458 23	***************************************
Sediment Transport in Gravel-Bed Rivers.	Time-Varying Stochastic Model of the Frequen- cy and Magnitude of Bed Load Transport	Blood Gases, Acid-Base Status, Ions, and Hema- tology in Adult Brook Trout (Salvelinus fontina-
W89-02430 2J	Events in Two Small Trout Streams,	lis) Under Acid/Aluminum Exposure, W89-03236 5C
River Bed Gravels: Sampling and Analysis, W89-02433 7B		
	Case Study of Minimum Streamflow for Fishery	Physiological Evidence of Acclimation to Acid/ Aluminum Stress in Adult Brook Trout (Salve-
Bed Load Sampling and Analysis, W89-02434 2J	Habitat in the Yampa River, W89-02460 2J	linus fontinalis): I. Blood Composition and Net Sodium Fluxes,
Sediment Supply to Upland Streams: Influence	Modelling Fluvial Processes in Streams with Gravel Mining.	W89-03237 5C
on Channel Adjustment, W89-02435 2J	W89-02462 2E	Physiological Evidence of Acclimation to Acid/ Aluminum Stress in Adult Brook Trout (Salve-
Sediment Supply, Movement and Storage in an Unstable Gravel-Bed River,	Aggradation and Degradation of Alluvial Sand Deposits, 1965 to 1986, Colorado River, Grand	linus fontinalis): II. Blood Parameters by Cannulation,
W89-02436 2J	Canyon National Park, Arizona, W89-02973 2J	W89-03238 5C
Transport Processes at the Catchment Scale,		Sodium Transport in the Brook Trout, Salve-
W89-02437 2J	ALLUVIAL FANS Hydrogeological Mapping in the Philippines, W89-02382 2F	linus fontinalis: Effects of Prolonged Low pH Exposure in the Presence and Absence of Alu-
Sediment Balance Considerations Linking Long- Term Transport and Channel Processes,	Some Relationships Between Debris Flow	minum, W89-03239 5C
W89-02438 2J	Motion and Micro-Topography for the Kamika-	F#
Static Armour Layers by Selective Erosion, W89-02439 2J	mihori Fan, North Japan Alps, W89-02907 2J	Effects of Low pH and Aluminum on Ventila- tion in the Brook Trout (Salvelinus fontinalis),
	Precise Measurement of Microforms and Fabric	W89-03240 5C
Formation of a Coarse Surface Layer as the Response to Gravel Mobility,	of Alluvial Cones for Prediction of Landform	Effect of Long-Term Exposure to Acid, Alumi-
W89-02440 2J	Evolution, W89-02908 2J	num, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): I. Survival, Growth, Fe-
River Bed Scour and Construction of Stone	ALLUVIAL SEDIMENTS	cundity, and Progeny Survival, W89-03241 5C
Riprap Protection, W89-02442 8A	Hydrogeology of the Butwal-Bhairahwa Area, Lumbini Zone, Nepal,	
Conceptual Models of Sediment Transport in	W89-02380 2F	Morphometric Changes in Gill Secondary La- mellae of Brook Trout (Salvelinus fontinalis)
Streams, W89-02443 2J	ALPINE REGIONS	after Long-Term Exposure to Acid and Alumi- num.
Investigation of Sediment Routing by Size Frac-	Some Relationships Between Debris Flow Motion and Micro-Topography for the Kamika-	W89-03243 5C
tions in a Gravel-Bed River,	mihori Fan, North Japan Alps,	AMAZON RIVER
W89-02444 2J	W89-02907 2J	Biogenic Gases and the Oxidation and Reduc-
Bed Load Discharge Equations for Steep Moun-	ALUM	tion of Carbon in Amazon River and Floodplain
tain Rivers,	Humic Substances Removal by Alum Coagula- tion: Direct Filtration at Low pH,	Waters, W89-03247 2E
W89-02445 2J	W89-02795 5F	
Field Measurements in a Gravel-bed River	Treatment of Rome Raw Water by Krofta Sand-	AMITROLE Capillary Gas Chromatographic Determination
which Confirm the Theory of White et al., W89-02446 2J	float Process System - Project Documentation (Part C),	of Amitrole in Water with Alkali Flame Ioniza- tion Detection,
Mountain Torrent Erosion,	W89-02943 5F	W89-03287 5A
W89-02447 2J	ALUMINUM	
Sediment Transport in Step-Pool Streams,	Discussion of the Changes in Soil Acidity Due	AMMONIA Anoxic/Oxic Activated Sludge Treatment of
W89-02448 2J	to Natural Processes and Acid Deposition,	Cyanogens and Ammonia in the Presence of
Bed Load Transport Measurements by the	W89-02307 5B	Phenols,
Vortex-tube Trap on Virginio Creek, Italy,	Differences in Aluminum Mobilization in Spodo-	W89-02298 5D
W89-02449 7B	sols in New Hampshire (USA) and in the Neth- erlands as a Result of Acid Deposition,	In Situ Aquifer Denitrification: Remediation of
Bed Load Transport in Desert Floods: Observa-	W89-02309 5B	Ammonia and Nitrate Contaminated Subsurface Environments,
tions in the Negev, W89-02450 2J	Thermodynamic Calculations with Special Ref-	W89-02359 5G
Influence of Large Suspended-Sediment Con-	erence to the Aqueous Aluminum System, W89-02641 2K	AMMUNITION PLANTS
centrations in Rivers,		Engineering/Cost Evaluation of Options for Re-
W89-02451 2J	Modeling the Effects of Adsorbed Hydrolyzed Al(III)-Ions on Deep Bed Filtration,	moval/Disposal of NC Fines, W89-02933 5D
Suspended Load in Gravel-Bed Rivers: UK Ex-	W89-02796 5F	
perience, W89-02452 2J	Interactions of Organic Matter and Aluminum Ions in Acid Forest Soil Solutions: Metal Com-	Toxicity of DEGDN, Synthetic-HC Smoke Combustion Products, Solvent Yellow 33 and
Energy Dissipation Rate Approach in River Me-	plexation, Flocculation, and Precipitation,	Solvent Green 3 to Freshwater Aquatic Orga- nisms,
chanics,	W89-03126 2K	W89-02936 50
W89-02453 2J	Temporal Variations in Dissolved and Particu-	AMPHIBODS
Extremal Hypotheses Applied to River Regime, W89-02454 2J	late Aluminum During a Spring Bloom, W89-03192 2L	AMPHIPODS Acute Toxicity of Binary Mixtures of Five Cations (Cu(2+), Cd(2+), Zn(2+), Mg(2+), and
Problems of Bed Load Transport in Braided	Effect of pH on Speciation and Toxicity of	K(+)) to the Freshwater Amphipod Gammaru
Gravel-Bed Rivers, W89-02455 21	Aluminum to Rainbow Trout (Salmo gairdneri), W89-03213	lacustris (Sars): Alternative Descriptive Models W89-03212 50
WANGIZA13 21	W 07-U3413 3C	W07-03414 34

ANABAENA

ANABAENA	Impairment of Mobility and Development in	AQUATIC ENVIRONMENT
Effect of Assam Crude on Photosynthesis and	Freshwater Snails (Physa fontinalis and Lym-	Nitrogen Fixation in Freshwater, Estuarine, and
Associated Electron Transport System in Ana-	naea stagnalis) Caused By Herbicides,	Marine Ecosystems: 1. Rates and Importance,
baena doliolum,	W89-03290 5C	W89-03254 2H
W89-03207 5C	ANION EVCHANCE	
	ANION EXCHANGE Limits on Cation Leaching of Weakly Podzo-	Nitrogen Fixation in Freshwater, Estuarine, and
ANAEROBIC DIGESTION		Marine Ecosystems: 2. Biogeochemical Con-
Anaerobic Treatment of Molasse/Sugar Cane	lized Forest Soils: An Empirical Evaluation, W89-02310 5B	trols,
Stillage with High Minerals,	W89-02310 5B	W89-03255 2H
W89-02289 5D	ANNUAL SUSPENDED LOAD	
	Sediment-Data Sources and Estimated Annual	Comparison of the Ecology of Planktonic Bacte-
Potential for Anaerobic Treatment of High	Suspended-Sediment Loads of Rivers and	ria in Fresh and Salt Water,
Sulfur Wastewater in a Unique Upflow - Fixed	Streams in Colorado,	W89-03258 2H
Film - Suspended Growth Reactor,	W89-02604 2J	
W89-02290 5D	W 67-02004	Comparative Ecology of the Macrofauna of
	ANODIC STRIPPING VOLTAMMETRY	Freshwater and Marine Muds,
Anaerobic Digestion of Chemical Industry	Comparison of Anodic Stripping Voltammetry	W89-03268 2H
Wastewaters Containing Toxic Compounds by	Speciation Data with Empirical Model Predic-	A CATA PROPERTY OF
Downflow Fixed Film Technology.	tions of pCu,	AQUATIC FUNGI
W89-02291 5D	W89-02646 7B	Bacteria and Fungi,
		W89-02769 7B
Fate of COD in an Anaerobic System Treating	ANOXIC ENVIRONMENTS	
High Sulphate Bearing Wastewater,	Hydrogen (H2) Distributions in the Carmans	AQUATIC HABITATS
W89-02295 5D	River Estuary,	Biological Surveys of Estuaries and Coasts.
	W89-03194 2L	W89-02759 7B
Pilot-Scale Anaerobic Biomass Acclimation		
Studies with a Coal Liquefaction Wastewater,	APALACHICOLA RIVER	AQUATIC LIFE
W89-02297 5D	Blountstown Reach, Apalachicola River, Mova-	Methods for Collection and Analysis of Aquatic
	ble-Bed Model Study,	Biological and Microbiological Samples,
Biotreatment Systems: Volume I.	W89-02416 2J	W89-02568 7B
W89-02914 5D	ACTIVITIC ANTHUM C	
A Ali Daniel Adam of Diameter Comments	AQUATIC ANIMALS Influence of a River Plume on the Sea-ice Meio-	AQUATIC PLANTS
Anaerobic Degradation of Phenolic Compounds	fauna in South-eastern Hudson Bay,	Interactions of Sphagnum with Water and Air,
with Applications to Treatment of Industrial		W89-02312 2H
Waste Waters,	W89-03189 2L	
W89-02918 5D	Diflubenzuron Application to Citrus and Its	Data on the Distribution and Abundance of Sub-
Minable Charles and Tasks desired Assessed	Impact on Invertebrates in an Adjacent Pond,	mersed Aquatic Vegetation in the Tidal Poto-
Microbial, Chemical, and Technological Aspects	W89-03208 5C	mac River and Estuary, Maryland, Virginia, and
of the Anaerobic Degradation of Organic Pollut-	W 65-03206 SC	the District of Columbia, 1986,
ants,	AQUATIC ECOSYSTEMS	W89-02511 7C
W89-02920 5D	Effects of Hydroelectric Scheme on Fluvial	
Biotreatment Systems: Volume II.	Ecosystems within the Spanish Pyrenees,	Aquatic Macrophytes in Adirondack (New
	W89-03138 6G	York) Lakes: Patterns of Species Composition in
W89-02921 5D		Relation to Environment,
Toxicity of Heavy Metals to Thermophilic An-	Operations for an Under-Ice Ecology Program,	W89-03056 5C
aerobic Digestion,	W89-03179 2H	
		Effect of Submersed Aquatic Macrophytes on
W89-02922 5D	Nitrogen Fixation in Freshwater, Estuarine, and	Resource Partitioning in Yearling Rock Bass
Bacterial Leaching of Heavy Metals from An-	Marine Ecosystems: 2. Biogeochemical Con-	(Ambloplites rupestris) and Pumpkinseeds (Le-
aerobically Digested Sludge,	trols,	pomis gibbosus) in Lake St. Clair,
W89-02925 5D	W89-03255 2H	W89-03171 2H
W 69-02923	Desitrification in Frankrustee and Constal	
Anaerobic Biological Process for the Prevention	Denitrification in Freshwater and Coastal	AQUATIC PRODUCTIVITY
of Noxious Odors in Pulp Manufacturing,	Marine Ecosystems: Ecological and Geochemi-	Above- and Below-Ground Macrophyte Pro-
W89-02928 5D	cal Significance,	duction in Scirpus Tidal Marshes of the St.
W 05-02520 3D	W89-03256 2H	Lawrence Estuary, Quebec,
Thermophilic Anaerobic Digestion of Winery	Comparison of Microbial Dynamics in Marine	W89-03055 2L
Waste (Vinasses): Kinetics and Process Optimi-	and Freshwater Sediments: Contrasts in Anaero-	
zation,	bic Carbon Catabolism,	AQUEOUS GEOCHEMISTRY
W89-03114 5D	W89-03257 2H	Concept of Electron Activity and its Relation to
30		Redox Potentials in Aqueous Geochemical Sys-
Influence of Na and Ca Alkalinity on UASB	Phototrophic Picoplankton: An Overview from	tems,
Treatment of Olive Mill Effluents: I. Preliminary	Marine and Freshwater Ecosystems,	W89-02580 2K
Results,	W89-03259 2H	11 05 02500
W89-03116 5D		AQUIFER CHARACTERISTICS
30	Comparative Ecology of Marine and Freshwater	Water Resources of Walworth County, South
Phosphate Requirement for Anaerobic Fixed	Phytoplankton,	Dakota,
Film Treatment of Landfill Leachate,	W89-03260 2H	W89-02489 2F
W89-03132 5D	NY . 1 Y 1	
	Nutrient Limitation of Phytoplankton in Fresh-	Geology of the Fresh Ground-Water Basin of
Anaerobic Fluidized Bed Treatment of an Indus-	water and Marine Environments: A Review of	the Central Valley, California, with Texture
trial Wastewater,	Recent Evidence on the Effects of Enrichment,	Maps and Sections,
W89-03162 5D	W89-03261 2H	W89-03032 2F
	Nuisance Phytoplankton Blooms in Coastal, Es-	
ANAEROBIC TREATMENT		Groundwater Flow through a Miliolite Lime-
Anaerobic Treatment of Sulfate-Containing	tuarine, and Inland Waters, W89-03262 2H	stone Aquifer,
Waste Water,	W89-03262 2H	W89-03050 2F
W89-02930 5D	Factors Controlling the Biogeochemical Cycles	
	of Trace Elements in Fresh and Coastal Marine	
ANIMAL BEHAVIOR	Waters as Revealed by Artificial Radioisotopes,	Effects of Irrigation Practices on Stream-Con-
Contrasting Diel Patterns of Vertical Migration	W89-03263 2H	
in the Dinoflagellate Ceratium hirundinella in		W89-02661 3F
Relation to Phosphorus Supply in a North Tem-	Applicability of Fish Yield Indices in Freshwa-	37 02001
perate Reservoir,	ter and Marine Ecosystems,	Summary of the High Plains Regional Aquifer-
W89-03221 2H		

Nebraska, New Mexico, Oklahoma, South	Configuration and Hydrology of the Pre-Creta-	New Water Policies for the West,
Dakota, Texas, and Wyoming, W89-03030 2F	ceous Rocks Underlying the Southeastern Coast- al Plain Aquifer System,	W89-02639 6D
		ARIZONA
Regional Aquifer System Underlying the North-		Impacts of Recharge Legislation on Groundwat-
ern Great Plains in Parts of Montana, North Dakota, South Dakota, and Wyoming: Summa-	Groundwater Flow System in Northern Missou- ri with Emphasis on the Cambrian-Ordovician	er Management in Arizona, W89-02336 4B
ry, W89-03033 2F	Aquifer, W89-03023 2F	Dry Wells - Solution or Pollution: An Arizona
Summary of the Hydrology of the Floridan Aq-	Effects of Future Ground-Water Pumpage on	Status Report,
uifer System in Florida and in Parts of Georgia, South Carolina, and Alabama,	the High Plains Aquifer in Parts of Colorado,	W89-02338 5B
W89-03034 2F	Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming,	Statewide Groundwater Quality Monitoring
AQUIFER TESTING	W89-03031 2F	Network Design, W89-02343 5A
Role of Aquifer Testing in Design of Constant-	Vulnerability Study of the Aubergenville Aqui-	Random Survey of VOC's, Pesticides and Inor-
Head Extraction Systems, W89-02346 7B	fer, W89-03077 5B	ganics in Arizona's Drinking Water Wells,
Improved Fresh Water Assessment in Sand		W89-02344 5A
Aquifers Utilizing Geophysical Well Logs, W89-02347 2F	Aquifer Thermal Energy Storage in Finland, W89-03082 4B	Hydrology of Area 62, Northern Great Plains
	Biodegradation Modeling at Aviation Fuel Spill	and Rocky Mountain Coal Provinces-New Mexico and Arizona,
AQUIFERS	Site,	W89-02498 2F
Transition from Ground-Water Mining to In- duced Recharge in Generalized Hydrogeologic	W89-03100 5G	Determination of Evaporation and Seepage
Systems, W89-02337 4B	Contaminated Aquifers are a Forgotten Compo-	Losses, Upper Lake Mary near Flagstaff, Arizo-
	nent of the Global N2O Budget, W89-03121 5B	na, W89-02558 2H
Simulating Underground Mines in a Regional Model.		W 87-02336 2F1
W89-02339 4C	Biodegradation of Nitrogen- and Oxygen-Con- taining Aromatic Compounds in Groundwater	Toward Sustaining a Desert Metropolis: Water and Land Use in Tucson, Arizona,
Statewide Groundwater Quality Monitoring	from an Oil-Contaminated Aquifer, W89-03149 5B	W89-02637 6D
Network Design, W89-02343 5A		Aggradation and Degradation of Alluvial Sand
Hydrogeology of the Butwal-Bhairahwa Area,	Modeling Groundwater Transport of Dissolved Gasoline and Using the Results to Evaluate Aq-	Deposits, 1965 to 1986, Colorado River, Grand Canyon National Park, Arizona,
Lumbini Zone, Nepal,	uifer Restoration Processes, W89-03321 5B	W89-02973 2J
W89-02380 2F	W89-03321 3B	ABTIANGAG
Development of Groundwater Resources in Sri	ARCTIC Soot from Arctic Haze: Radiative Effects on the	ARKANSAS Groundwater Levels in the Alluvial Aquifer in
Lanka, W89-02383 4B	Arctic Snowpack,	Eastern Arkansas, 1986,
	W89-02611 2C	W89-02522 2F
Water Resources of Walworth County, South Dakota,	Snow Cover Record in Eurasia,	Generalized Potentiometric Surface of the
W89-02489 2F	W89-02612 2C	Sparta-Memphis Aquifer, Eastern Arkansas, Spring 1980,
Geohydrology and Susceptibility of Major	ARCTIC ZONE	W89-02575 7C
Aquifers to Surface Contamination in Alabama;	Oil Spill Combat in the Arctic - An Alternative	
Area 9, W89-02563 5B	Approach, W89-02966 5G	Annual Yield and Selected Hydrologic Data for the Arkansas River Basin Compact, Arkansas-
Geohydrology and Susceptibility of Major	AREAL HYDROGEOLOGY	Oklahoma, 1987 Water Year, W89-02602 2E
Aquifers to Surface Contamination in Alabama;	Hydrology of Area 59, Northern Great Plains	W89-02002 2E
Area 8,	and Rocky Mountain Coal Provinces, Colorado	ARKANSAS RIVER
W89-02564 5B	and Wyoming, W89-02501 2E	Relations of Specific Conductance to Stream- flow and Selected Water Quality Characteristics
Geohydrology and Susceptibility of Coldwater Spring and Jacksonville Fault Areas to Surface	Hydrogeology of the Socorro and La Jencia	of the Arkansas River Basin, Colorado,
Contamination in Calhoun County, Alabama,	Basins, Socorro County, New Mexico,	W89-02599 2K
W89-02576 5B	W89-02517 2F	AROCLORS
Geohydrology and Susceptibility of Major	ARID LANDS	Horizontal and Vertical Distribution of PCBs in
Aquifers to Surface Contamination in Alabama,	Water and Arid Lands of the Western United	Southern Lake Michigan Sediments and the Effect of Waukegan Harbor as a Point Source,
Area 7, W89-02577 5B	States. W89-02630 6D	W89-03170 5B
Geohydrology and Susceptibility of Major	West in Profile,	AROMATIC COMPOUNDS
Aquifers to Surface Contamination in Alabama,	W89-02631 6D	Literature Study on the Feasibility of Microbio-
Area 1, W89-02578 5B	Great American Desert Transformed: Aridity,	logical Decontamination of Polluted Soils,
	Exploitation, and Imperialism in the Making of	W89-02916 5G
Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama,	the Modern American West, W89-02632 6D	Biodegradation of Nitrogen- and Oxygen-Con- taining Aromatic Compounds in Groundwater
Area 6, W89-02590 5B	Land and Water Management Issues: Texas	from an Oil-Contaminated Aquifer,
Groundwater Flow in the Lowland Limestone	High Plains, W89-02634 6D	W89-03149 5B
Aquifer of Eastern Co. Galway and Eastern Co.		Biological Transformation and Detoxification of 7,12-Dimethylbenz(a)anthracene in Soil Systems,
Mayo, Western Ireland, W89-02736 2F	Water Resources of the Upper Colorado River Basin: Problems and Policy Alternatives,	7,12-Dimethylbenz(a)anthracene in Soil Systems, W89-03161 5B
	W89-02635 6D	ARSENIC
Isotopic Investigation on the Evolution of Groundwater Dynamics in the Principal	Toward Sustaining a Desert Metropolis: Water	Supplemental Arsenic Data for Selected Streams
Aquifers in the Southern Dobrudja,	and Land Use in Tucson, Arizona,	in the Missouri River Basin, Montana, 1987,
W89-02853 2F	W89-02637 6D	W89-02516 5B

SUBJECT INDEX

ARTESIAN AQUIFERS

RTESIAN AQUIFERS	Circulation in East Asia and Precipitation in	AZO DYES
Selected Geohydrologic Characteristics of the	China,	Fate of Water Soluble Azo Dyes in the Activat-
Patapsco Aquifer at Chalk Point, Prince Georges County, Maryland,	W89-02609 2C	ed Sludge Process, W89-02935 5D
W89-02560 2F	ASSIMILATIVE CAPACITY	W 67-02733
RTESIAN WELLS	Effects of Cadmium Exposure on Feeding of Freshwater Planktonic Crustaceans,	Biological Wastewater Treatment of Azo Dyes, W89-03327 5D
Summary of Well Construction, Testing, and	W89-03288 5C	DACHULTED
Preliminary Findings from the Alligator Alley	ATMOSPHERE	BACKWATER Use of Remote Gauging to Measure Sewer
Test Well, Broward County, Florida, W89-02465 4B	Modelling a Seasonal Snow Cover,	Invert Elevations and Head Loss, W89-03280 5D
RTIFICIAL RECHARGE	W89-02627 2C	
Assessment of the Adequacy of the Ground-	Potential Impacts of a Scenario of CO2-Induced	BACTERIA
Water Monitoring System for Artificial Re- charge of Aquifers in the Los Angeles Area,	Climatic Change on Ontario, Canada, W89-03063 2A	Microtox Assessment of Anaerobic Bacterial Toxicity, W89-02301 5D
California, W89-02335 7A	ATMOSPHERIC CIRCULATION	
	Effects of Snow Cover and Tropical Forcing on	Bacterial Leaching of Heavy Metals from An-
Impacts of Recharge Legislation on Groundwat-	Mid-Latitude Monthly Mean Circulation,	aerobically Digested Sludge, W89-02925 5D
er Management in Arizona, W89-02336 4B	W89-02625 2C	
	Characteristics of Seasonal Snow Cover as Sim-	Movement and Survival of Bacteria in Porous
Transition from Ground-Water Mining to In- duced Recharge in Generalized Hydrogeologic	ulated by GFDL Climate Models, W89-02628 2C	Media, W89-03080 5B
Systems, W89-02337 4B	ATMOSPHERIC PHYSICS	Ground Water: A Living Ecosystem,
W 69-02337	Consequences of Cloud Water Deposition on	W89-03084 2F
Dry Wells - Solution or Pollution: An Arizona	Vegetation at High Elevation,	Potential of Free-Living Ground Water Bacteria
Status Report, W89-02338 5B	W89-02305 5B	to Degrade Aromatic Hydrocarbons and Heter-
	ATMOSPHERIC PRECIPITATION	ocyclic Compounds,
Recharge as Augmentation in the South Platte	NETWORKS	W89-03086 5B
Basin, W89-02482 4B	Directory of Precipitation Monitoring Sites, Na-	Effect of Unsaturated/Saturated Zone Property
W 89-02482 4B	tional Atmospheric Deposition Program/Na-	Upon the Hydrogeochemical and Microbiologi-
Groundwater Resources of Limestone County,	tional Trends Network (NADP/NTN). W89-02480 7A	cal Processes Involved in the Migration and
Texas,	W 07-02400	Attenuation of Landfill Leachate Components, W89-03087 5B
W89-02583 2F	ATMOSPHERIC WATER	W 07-03007
Ground Water Recharge for Oklahoma: An	Influence of Potential Evaporation on the Varia-	Biological Treatment of Groundwater in Basins
Analysis of Past and Future Methodology, W89-02660 4B	bilities of Simulated Soil Wetness and Climate, W89-03308 2D	with Floating Filters: II. The Role of Microor- ganisms in Floating Filters,
Odour Control by Artificial Groundwater Re-	ATOLLS	W89-03095 5G
charge,	Phytokarst, Blue-green Algae and Limestone	Volatilization of Mercury Compounds by Meth-
W89-02799 5F	Weathering,	ylmercury-Volatilizing Bacteria in Minamata
Groundwater Flow through a Miliolite Lime-	W89-02732 2K	Bay Sediment, W89-03197 5B
stone Aquifer,	ATOMIC ABSORPTION SPECTROSCOPY	W89-03197
W89-03050 2F	Chromatographic Approaches to Trace Element	Growth and Phosphorous Status of Limnetic
Vulnerability Study of the Aubergenville Aqui-	Speciation,	Phytoplankton and Bacteria, W89-03244 2H
fer,	W89-02648 5A	W 69-03244 2H
W89-03077 5B	AUGMENTATION PLAN	Comparison of the Ecology of Planktonic Bacte-
Investigation into Mechanisms of Microbial Ef-	Recharge as Augmentation in the South Platte	ria in Fresh and Salt Water, W89-03258 2H
fects on Iron and Manganese Transformations in	Basin, W89-02482 4B	W89-03258 2H
Artificially Recharged Groundwater,	W 89-02482 4B	Phototrophic Picoplankton: An Overview from
W89-03078 4B	AUSTIN	Marine and Freshwater Ecosystems, W89-03259 2H
Aquifer Thermal Energy Storage in Finland,	Hydrologic Data for Urban Studies in the	W89-03259 2H
W89-03082 4B	Austin Metropolitan Area, Texas, 1986, W89-02597 4C	Nuisance Phytoplankton Blooms in Coastal, Es-
ASBESTOS	1107-02377	tuarine, and Inland Waters,
Asbestos-Contaminated Drinking Water: Its	AUSTRALIA	W89-03262 2H
Impact on Household Air,	Assessment and Mapping of Australia's Ground-	BACTERIAL ANALYSIS
W89-03299 5B	water Resources, W89-02365 2F	Bacteria and Fungi,
ASHLEY RESERVOIR		W89-02769 7B
Treatment of Farnham and Ashley Reservoir	Circulation Anomalies in Tropical Australian	Water Analysis: A Practical Guide to Physico-
Water by Krofta Sandfloat Process System -	Estuaries, W89-02697 2L	Chemical, Chemical and Microbiological Water
Project Documentation, W89-02950 5F		Examination and Quality Assurance, W89-02777 7B
W89-02950 5F	AUSTRIA	W 03-02111 /B
Treatment of Farnham and Ashley Reservoir	New Lebring Scheme Replaces the Oldest Plant on the Mur,	Bacterial Loadings from Resuspended Sediments
Water by Krofta Sandfloat Process System -	W89-03153 8C	in Recreational Beaches, W89-03136 5B
Final Project Report, W89-02951 5F		W89-03136 5B
	AUTOMATION	Concentration of Mycobacterium avium by Hos-
ASIA Hydrogeological Manning in Asia and the Pacif	Hydrology and Data Acquisition, W89-02726 2A	pital Hot Water Systems,
Hydrogeological Mapping in Asia and the Pacif- ic Region.		W89-03304 5B
W89-02364 7B	AUTOMOTIVE INDUSTRY	BACTERICIDES
Relationships between Snow Cover and Tem-	Pretreatment of Wastewater from the Automo- bile Industry,	Hexachlorophene Distributions in Estuarine
perature in the Lower Troposphere, General	W89-02804 5D	Sediments, W89-03196 5B

BADLANDS	Field Measurements in a Gravel-bed River	BIBLIOGRAPHIES
Runoff and Sediment Transport Dynamics in Canadian Badland Micro-Catchments,	which Confirm the Theory of White et al., W89-02446	Selected Literature on Water Resources Investi-
W89-02887 2E	W89-02446 2J	gations in New Jersey by the U.S. Geological
	Bed Load Transport Measurements by the	Survey, Through 1986, W89-02466 10C
BALTIMORE	Vortex-tube Trap on Virginio Creek, Italy,	W89-02466 10C
Patapsco Wastewater Treatment Plant Toxicity	W89-02449 7B	Water Resources Publications of the U.S. Geo-
Reduction Evaluation, W89-02300 5D	Red Land Transport in Decest Floods Observe	logical Survey, For Tennessee, 1906-1987,
	Bed Load Transport in Desert Floods: Observa- tions in the Negev,	W89-02467 10C
BANG PAKONG ESTUARY	W89-02450 2J	Bibliography of H.C. Coological Comm. B.
Trace Metal Transport in a Tropical Estuary, W89-03276 2L	-	Bibliography of U.S. Geological Survey Reports on the Water Resources of Florida, 1886-1984,
W 69-032/0	Influence of Large Suspended-Sediment Con-	W89-02527 10C
BANGLADESH	centrations in Rivers,	
Water-Bearing Zones in the Mining Area of the	W89-02451 2J	Desalination of Water. Citations from the COM-
Northern Region of Bangladesh with Regard to	Problems of Bed Load Transport in Braided	PENDEX Engineering Information, Inc. Data-
Utilization of Mine Water for Irrigation and Other Uses,	Gravel-Bed Rivers,	base (Dec 83 - Sep 87).
W89-02369 2F	W89-02455 2J	W89-02782 3A
B LAW BROOKS	Interaction of Bed Load Transport with Bars,	Dredging: Technology and Environmental As-
BANK EROSION Mountain Torrent Erosion,	W89-02456 2J	pects. Citations from the Life Sciences Collec-
W89-02447 2J	11 07-02-130	tion Database (Jan 78 - Aug 87).
	Time-Varying Stochastic Model of the Frequen-	W89-02783 2J
Analysis of Bank Stability in the DEC Water-	cy and Magnitude of Bed Load Transport	Acid Precipitation. Citations from the COM-
sheds, Mississippi, W89-02825 4D	Events in Two Small Trout Streams, W89-02459 2J	PENDEX Engineering Information Inc. Data-
W 69-02623	W89-02459 2J	base (Sept 84 - Aug 86).
Role of Ice in the Morpho-Sedimentologic	Hydrologic Data for Computation of Sediment	W89-02784 5B
Regime of a Shoreline in the Middle Saint Law-	Discharge, Toutle and North Fork Toutle	
rence Estuary (Le Role des Glaces dans le Regime Morpho-Sedimentologique d'un Estran	Rivers near Mount St. Helens, Washington,	Acid Precipitation. Citations from the COM-
de l'Estuaire Moyen du Saint-Laurent),	1980-84.	PENDEX Engineering Information Inc. Data- base (Sept 86 - Aug 87).
W89-03133 2J	W89-02571 7C	W89-02785 5B
	BED LOAD SAMPLERS	W 05-02705
BANK PROTECTION	River Bed Gravels: Sampling and Analysis,	Wastewater Treatment: Ozonation Processes
Definite Project Report for Section 14. Emer- gency Streambank Protection, Sangamon River	W89-02433 7B	and Equipment. Citations from the Selected
Sewage Treatment Facility, Riverton, Illinois.		Water Resources Abstracts Database (Jan 77 -
W89-02934 4D	Bed Load Transport Measurements by the Vortex-tube Trap on Virginio Creek, Italy,	Aug 87). W89-02786 5D
DANIE OF A DAY PEV	W89-02449 7B	W89-02786 5D
BANK STABILITY Analysis of Bank Stability in the DEC Water-	10702475	BIOACCUMULATION
sheds, Mississippi,	BED LOAD SAMPLES	'Mussel Watch'-Measurements of Chemical Pol-
W89-02825 4D	Bed Load Sampling and Analysis,	lutants in Bivalves as One Indicator of Coastal
DADNIACT DO	W89-02434 2J	Environmental Quality,
BARNACLES Effects of Water Soluble Crude Oil Fractions on	BELLEVUE	W89-02326 5A
Cirral Beat Frequency in Balanus balanoides,	Quantity and Quality of Storm Runoff from	Metal Speciation and Interactions among Ele
W89-03205 5C	Three Urban Catchments in Bellevue, Washing-	ments Affect Trace Element Transfer in Agri-
BASELINE STUDIES	ton,	cultural and Environmental Food-Chains,
Evaluation of Baseline Conditions at Lease	W89-03000 5B	W89-02650 5E
Tract C-a, Rio Blanco County, Colorado,	BENTHIC FAUNA	Trees Matel Secretation in Sediments and Sails
W89-02974 5B	Macrofauna of Subtidal Sediments Using	Trace Metal Speciation in Sediments and Soils An Overview from a Water Industry Perspec
Monitoring Baseline Suspended Sediment in	Remote Sampling,	tive,
Forested Basins: The Effects of Sampling on	W89-02764 2L	W89-02651 5I
Suspended Sediment Rating Curves,	P	
W89-03053 2J	Processing Sediment Macrofauna Samples, W89-02765 7B	Transport, Bioaccumulation, and Toxicity of
BEACHES	W89-02/03	Metals and Metalloids in Microorganisms unde
Bacterial Loadings from Resuspended Sediments	Meiofauna,	Environmental Stress, W89-02652 51
in Recreational Beaches,	W89-02766 2L	W 89-02032
W89-03136 5B	Littoral Zoobenthic Biomass in Lakes, and Its	Gastrointestinal Absorption of Soluble Uranium
BED LOAD	Relationship to Physical, Chemical, and Trophic	from Drinking Water,
Sediment Transport in Gravel-Bed Rivers.	Factors,	W89-02957 51
W89-02430 2J	W89-03229 2H	Distribution Pattern and Reduction of Polychlo
Diff P-t C11 C111		1
Differences Between Gravel- and Sand-bed Rivers,	Comparative Ecology of the Macrofauna of	saltatrix (Linnaeus) Fillets through Adipos
W89-02431 2J	Freshwater and Marine Muds, W89-03268 2H	Tierra Demoual
	W 65-03200 211	W89-03199 51
Bed Load Sampling and Analysis,	BENTHIC INVERTEBRATES	Assumulation of Codmiss by Briskers Town
W89-02434 2J	Water Quality Data for the Boise River, Boise to	Accumulation of Cadmium by Rainbow Trous Salmo Gairdneri, During Extended Exposure
Formation of a Coarse Surface Layer as the	Star, Idaho, October to December 1987,	*****
Response to Gravel Mobility,	W89-02464 5C	1. 37-03220
W89-02440 2J	BENTHOS	Pesticides in Fish Tissue and Water from Tutti
Conceptual Models of Sediment Transport in	Mobile Bay Estuary: Stratification, Oxygen De-	Creek Lake, Kansas,
Streams,	pletion, and Jubilees,	W89-03317 5
W89-02443 2J	W89-02696 2L	BIOASSAYS
Bed Load Discharge Equations for Steep Moun-	Comparative Ecology of the Macrofauna of	
tain Rivers,	Freshwater and Marine Muds,	hibition Using Enriched Nitrosomonas Culture
W90 02445	W90 02269 2U	W90.0202 7

SUBJECT INDEX

BIOCHEMICAL OXYGEN DEMAND

BIOCHEMICAL OXYGEN DEMAND BOD and Nutrient Removal by Biological A/O Process Systems, W89-03326 5D	Biodegradation of Nitrogen- and Oxygen-Containing Aromatic Compounds in Groundwater from an Oil-Contaminated Aquifer, W89-03149 5B	BIOLOGICAL SURVEYS Monitoring the Nation's WatersA New Perspective, W89-02318 5A
BIOCHEMICAL TESTS Biochemical Testing of Groundwater, W89-03085 5A	Biological Transformation and Detoxification of 7,12-Dimethylbenz(a)anthracene in Soil Systems, W89-03161 5B	Biological Surveys of Estuaries and Coasts. W89-02759 7B
***************************************	W89-03101	Planning Biological Surveys,
BIOCHEMISTRY	Pilot Plant Demonstration of In-situ Biodegrada-	W89-02760 7B
Long-Term Sublethal Acid Exposure in Rain-	tion of 1,1,1-Trichloroethane,	
bow Trout (Salmo gairdneri) in Soft Water:	W89-03164 5D	BIOLOGICAL TREATMENT
Effects on Ion Exchanges and Blood Chemistry,		Process Development and Treatment Plant
W89-03226 5C	Role of Protozoa in Microbial Acclimation for	Startup for an Explosives Industry Wastewater,
Physiological Evidence of Acclimation to Acid/	Mineralization of Organic Chemicals in Sewage,	W89-02287 5D
Aluminum Stress in Adult Brook Trout (Salve-	W89-03283 5D	T
linus fontinalis): I. Blood Composition and Net	BIOFILTRATION	Treatment of Process Wastewater from Petro- chemical Plant Using a Rotating Biological Con-
Sodium Fluxes,	Treatment of Groundwater with Slow Sand Fil-	tactor - A Case Study,
W89-03237 5C	tration,	W89-02292 5D
	W89-03090 5F	W 65-02222
Physiological Evidence of Acclimation to Acid/		Chemical-Biological Treatment versus Chemical
Aluminum Stress in Adult Brook Trout (Salve-	BIOGEOCHEMISTRY	Treatment: A Case Study,
linus fontinalis): II. Blood Parameters by Cannu-	Biogeochemistry of Lead-210 and Polonium-210	W89-02814 5D
lation,	in Fresh Waters and Sediments,	
W89-03238 5C	W89-02555 2K	Handbook: Improving POTW Performance
Sodium Transport in the Brook Trout, Salve-	Sediment Record of Biogeochemical Responses	Using the Composite Correction Program Approach,
linus fontinalis: Effects of Prolonged Low pH	to Anthropogenic Perturbations of Nutrient	W89-02845 5D
Exposure in the Presence and Absence of Alu-	Cycles in Lake Ontario,	W 67-02043
minum,	W89-03222 2H	Biotreatment Systems: Volume I.
W89-03239 5C		W89-02914 5D
France Controlling the Disconsherminal Cualca	BIOINDICATORS	
Factors Controlling the Biogeochemical Cycles of Trace Elements in Fresh and Coastal Marine	Strategies for Long-Term Pollution Monitoring	Biotreatment Systems: Volume II.
Waters as Revealed by Artificial Radioisotopes,	of the Coastal Oceans,	W89-02921 5D
W89-03263 2H	W89-02319 5A	In Situ Biological Treatment of Hazardous
1107-03203	'Mussel Watch'Measurements of Chemical Pol-	Waste-Contaminated Soils,
BIODEGRADATION	lutants in Bivalves as One Indicator of Coastal	W89-02923 5D
In Situ Aquifer Denitrification: Remediation of	Environmental Quality,	
Ammonia and Nitrate Contaminated Subsurface	W89-02326 5A	Biotreatment Systems: Volume III.
Environments,		W89-02927 5D
W89-02359 5G	Critical Assessment of the 'Dynamic Daphnia	Evaluation of Dialogical Teastment of Phones
Agricultural Impact on Groundwater Quality,	Test' (Kritische Betrachtung des 'Dynamischen	Evaluation of Biological Treatment of Pharma- ceutical Wastewater with PAC Addition.
W89-02549 5B	Daphnien Tests'), W89-03046 5A	Volume I,
	W 69-03040 SA	W89-02948 5D
Quantitative Studies of Biodegradation of Petro-	Modification and Assessment of an Index of	
leum And Some Model Hydrocarbons in	Biotic Integrity to Quantify Stream Quality in	Evaluation of Biological Treatment of Pharma-
Ground Water and Sediment Environments, W89-02674 5B	Southern Ontario,	ceutical Wastewater with PAC Addition.
W89-02074 3B	W89-03211 4C	Volume II - Appendices,
Literature Study on the Feasibility of Microbio-	Salad Chamber (Chamber) - Inti	W89-02949 5D
logical Decontamination of Polluted Soils,	Scaled Chrysophytes (Chrysophyceae) as Indi- cators of pH in Sudbury, Ontario, Lakes,	Utilization of Biological Methods in Groundwat-
W89-02916 5G	W89-03227 5A	er Treatment,
Assemblic Describation of Manager Community	W 67-03221 3A	W89-03088 5F
Anaerobic Degradation of Phenolic Compounds	BIOLOGICAL MARKERS	1107 00000
with Applications to Treatment of Industrial Waste Waters,	New Biological Marker Layer in the Sediments	Treatment of Groundwater with Slow Sand Fil-
W89-02918 5D	of the Great Lakes: Bythothrephes cederstroemi	tration,
30	(Schodler) Spines,	W89-03090 5F
Biological Treatment of Toxic Industrial Waste,	W89-03178 2H	VYREDOX and NITREDOX Methods of In
W89-02919 5D	BIOLOGICAL SAMPLES	situ Treatment of Groundwater,
Microbial, Chemical, and Technological Aspects	Methods for Collection and Analysis of Aquatic	W89-03091 5F
of the Anaerobic Degradation of Organic Pollut-	Biological and Microbiological Samples,	
ants,	W89-02568 7B	Modelling of Flow and Transport Processes in
W89-02920 5D		Vyredox and Nitredox Subsurface Treatment
	Processing Sediment Macrofauna Samples,	Plants,
In Situ Biological Treatment of Hazardous	W89-02765 7B	W89-03092 5F
Waste-Contaminated Soils,	BIOLOGICAL STUDIES	Biotechnology for Manganese Removal from
W89-02923 5D	Biology of the Walleye in Lake Sharpe, South	Groundwater,
Role of Phenolic and Humic Compounds in	Dakota, 1964-1975,	W89-03093 5F
Anaerobic Digestion Processes,	W89-02427 2H	District Towns CO. 1
W89-02924 5D	Dislam of the Velley Book in Take Of	Biological Treatment of Groundwater in Basins
Groundwater Microbiology: Problems and Bio-	Biology of the Yellow Perch in Lake Sharpe, South Dakota, 1964-1975,	with Floating Filters: I. Test Arrangements and General Results,
logical Treatment: State-of-the-Art Report,	South Dakota, 1964-1975, W89-02428 2H	W89-03094 5F
W89-03075 2F		57-05074
	Early Life History and Winter Mortality of Giz-	Biological Treatment of Groundwater in Basins
Biological Degradation of Volatile Chlorinated	zard Shad in Lake Sharpe, South Dakota,	with Floating Filters: II. The Role of Microor-
Hydrocarbons in Groundwater,	W89-02429 2H	ganisms in Floating Filters,
W89-03081 5B	Chemical and Biological Survey of Lakes and	W89-03095 5G
Biodegradation Modeling at Aviation Fuel Spill	Streams Located in the Emerald Lake Water-	Biological Groundwater Denitrification: Labo-
Site,	shed, Sequoia National Park,	ratory Studies,
W89-03100 5G	W89-02852 2H	W89-03096 5F

In Situ Biological Groundwater Denitrification:	Influence of Na and Ca Alkalinity on UASB	BOGS
Concepts and Preliminary Field Tests,	Treatment of Olive Mill Effluents: I. Preliminary	Acidification and Succession in a Flood-Plain
W89-03097 5G	Results, W89-03116 5D	Mire in the Norfolk Broadland, U.K.,
Promising Technologies for the Biological De-	W89-03116	W89-03123 2H
toxification of Hazardous Waste, W89-03322 5D	Phosphate Requirement for Anaerobic Fixed Film Treatment of Landfill Leachate,	Characteristics of the Sorption of Chlorothalonil and Azinphos-Methyl to a Soil from a Commer-
DIOLOGICAL WASTEWATER TREATMENT	W89-03132 5D	cial Cranberry Bog,
BIOLOGICAL WASTEWATER TREATMENT Pre-Precipitation for Improvement of Nitrogen	Unit Process Tradeoffs for Combined Trickling	W89-03195 5B
Removal in Biological Wastewater Treatment,	Filter and Activated Sludge Processes,	Effect of Climate on Development of Tour
W89-02812 5D	W89-03160 5D	Effect of Climate on Development of Two Sphagnum Bogs in South-Central Wisconsin,
Influence of Studen from Chamical Biological	E-bd Cd Ttt Iti	W89-03293 2H
Influence of Sludge from Chemical Biological Wastewater Treatment on Nitrification and Di-	Enhanced Secondary Treatment Incorporating Biological Nutrient Removal,	
gestion,	W89-03163 5D	BOISE RIVER
W89-02816 5D		Water Quality Data for the Boise River, Boise to Star, Idaho, October to December 1987,
Distance Volume I	Biological Wastewater Treatment of Azo Dyes, W89-03327 5D	W89-02464 5C
Biotreatment Systems: Volume I. W89-02914 5D	W 89-03321	191
	Stringfellow Leachate Treatment with RBC,	BOREHOLE DILUTION INSTRUMENT
Aerobic Treatment of Sewage from Lignite	W89-03328 5D	Measurement of Groundwater Velocity with a
(Brown Coal) Processing, W89-02915 5D	BIOMASS	Colorimetric Borehole Dilution Instrument, W89-02345 7B
W 69-02913	Zooplankton Biomass Exchange in Lake Sharpe,	1107-02545
Treatment of Hazardous Wastes in a Sequencing	South Dakota, 1974-1975,	BOREHOLE GEOPHYSICS
Batch Reactor,	W89-02425 2H	Improved Fresh Water Assessment in Sand
W89-02917 5D	Biochemical Testing of Groundwater,	Aquifers Utilizing Geophysical Well Logs,
Anaerobic Degradation of Phenolic Compounds	W89-03085 5A	W89-02347 2F
with Applications to Treatment of Industrial	E-corona of Chicanomides (Dinters) in Festil	Geophysical Logs and Hydrological Data for
Waste Waters,	Emergence of Chironomidae (Diptera) in Fertil- ized and Natural Lakes at Saqvaqjuac, N.W.T.,	Eight Wells in the Coyote Spring Valley Area,
W89-02918 5D	W89-03216 2H	Clark and Lincoln Counties, Nevada,
Biological Treatment of Toxic Industrial Waste,		W89-02603 4B
W89-02919 5D	Contrasting Patterns of Net- and Nanoplankton	BOTTOM SEDIMENTS
Missabial Chamical and Trabanismis Assessed	Production and Biomass Among Lakes, W89-03218 2H	Sediment Transport from Delaware Bay to the
Microbial, Chemical, and Technological Aspects of the Anaerobic Degradation of Organic Pollut-		New Jersey Inner Shelf,
ants,	Littoral Zoobenthic Biomass in Lakes, and Its	W89-03187 2J
W89-02920 5D	Relationship to Physical, Chemical, and Trophic Factors.	Hydrogen (H2) Distributions in the Carmans
Di-ttt St W-b H	W89-03229 2H	River Estuary.
Biotreatment Systems: Volume II. W89-02921 5D		W89-03194 2L
	Interrelationship Between In Vivo Fluorescence	BRIDGE BEGICN
Biodegradation of Recalcitrant Industria	of Phytoplankton and Light Beam Transmission with Reference to Fluorescence Yield,	BRIDGE DESIGN Techniques for Estimating Regional Flood
Wastes, W89-02926 5D		Characteristics of Small Rural Watersheds in the
W 87-02720		Plains Region of Eastern Colorado,
Biotreatment Systems: Volume III.	Microflagellate-Picoplankton Food Linkage in	W89-02507 2E
W89-02927 5E	the Water Column of Lake Biwa, W89-03245 2H	BRIDGES
Potential for Treatment of Hazardous Organic		I-664 Bridge-Tunnel Study, Virginia Sedimenta-
Chemicals with Biological Processes,	BIOTRANSFORMATION	tion and Circulation Investigation,
W89-02929 5I	Biological Transformation and Detoxification of 7,12-Dimethylbenz(a)anthracene in Soil Systems,	W89-02875 4C
Anaerobic Treatment of Sulfate-Containing		BUFFALO GOURDS
Waste Water,		Use of Saline Water for Buffalo Gourd Produc-
W89-02930 5I		tion in New Mexico,
Enhanced Biological Phosphorus Removal from	ylmercury-Volatilizing Bacteria in Minamata Bay Sediment,	W89-02475 3C
Waste Waters,	W89-03197 5B	
W89-02931 5I		BULB TURBINES Developments in the Design of Bulb Turbines
Comparison Between Wasse Wasse Torrison	BIRDS	Developments in the Design of Bulb Turbines, W89-03069
Comparison Between Waste Water Treatment i Completely Mixed and Fluidized Bed Reactor		
Development and Structure of Biomass (Vers		Calculation of Prototype Cavitation Characteris-
leich der Absasserreinigung im Ruhr - und ir	BLEACHING WASTES	tics in Large Bulb Turbines, W89-03070 8C
Wirbelbettreaktor Sowie Entwicklung un	Physiological Disturbances in Fish Living in	W89-03070 8C
Struktur der Biomasse),	Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents,	Uprating the Laufenburg Swiss/German Power
W89-03045 51	W89-03234 5C	Station with Ten Straflo Units,
VYREDOX and NITREDOX Methods of I	n	W89-03071 8C
situ Treatment of Groundwater,	BLOOMS Nuisance Phytoplankton Blooms in Coastal, Es-	BULRUSHES
W89-03091 5	tuarine, and Inland Waters.	Above- and Below-Ground Macrophyte Pro-
Pilot-Plant Evaluations of Porous Biomass Sup		duction in Scirpus Tidal Marshes of the St.
ports,	DI ALIAMANANIA DILI COLI	Lawrence Estuary, Quebec,
W89-03104 5	BLOUNTSTOWN REACH Blountstown Reach, Apalachicola River, Mova-	W89-03055 2L
Thermophilic Anaerobic Digestion of Winer		CADMIUM
Waste (Vinasses): Kinetics and Process Optim		Distribution of Contaminants in Clams and Sedi-
zation,	DI LIPPONI	ments from the Huron-Erie Corridor: II. Lead
W89-03114 5	Distribution Pattern and Reduction of Polychlo-	and Cadmium, W89-03177 5B
Syntrophic Bacteria Process to Convert a Pu		W-03-U31//
Mill's Spent Sulphite Liquor to Hydrogen Su		Accumulation of Cadmium by Rainbow Trout,
phide,	Tissue Removal,	Salmo Gairdneri, During Extended Exposure,
W89-03115 5	D W89-03199 5B	W89-03220 5B

CADMIUM

Effects of Liming on the Distribution of Cadmi- um in Water, Sediment, and Organisms in a Swedish Lake,	Fertility and Disturbance Gradients: A Summary Model for Riverine Marsh Vegetation, W89-03294 2H	Geohydrology and Susceptibility of Coldwater Spring and Jacksonville Fault Areas to Surface Contamination in Calhoun County, Alabama,
W89-03224 5B	Organic Contaminants in Isolated Lakes of	W89-02576 5B
Effects of Cadmium Exposure on Feeding of Freshwater Planktonic Crustaceans,	Southern Labrador, Canada, W89-03318 5B	Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama,
W89-03288 5C	CANAL CONSTRUCTION	Area 1,
	Canal Design by an Armouring Process,	W89-02578 5B
Effects of Cadmium on Consumption, Assimila-	W89-02441 8A	CARCINOGENS
tion and Biochemical Parameters of Daphnia		Asbestos-Contaminated Drinking Water: Its
magna: Possible Implications for Reproduction, W89-03289 5C	CANAL DESIGN	Impact on Household Air,
W 67-03267	Canal Design by an Armouring Process, W89-02441 8A	W89-03299 5B
ALIFORNIA	W 07-02441	CLCT CTUDING
Assessment of the Adequacy of the Ground-	CANAL LININGS	CASE STUDIES
Water Monitoring System for Artificial Re- charge of Aquifers in the Los Angeles Area, California,	Canal Design by an Armouring Process, W89-02441 8A	Waste Minimization Audit Report: Case Studies of Minimization of Solvent Wastes and Electro- plating Wastes at a DOD (Department of De-
W89-02335 7A	CANALS	fense) Installation,
	Seepage Study of A 15.3 Mile Section of the	W89-02839 5D
Use of Well Packers To Control TCE and PCE	Central Utah Canal, Pahvant Valley, Millard	CASTLE AIR FORCE BASE
Contaminants,	County, Utah, W89-02469 2E	Wastewater Characterization and Hazardous
W89-02356 5G	W 89-02409	Waste Survey, Castle AFB, CA,
Advantages of Suction Lift Hydrocarbon Re-	Design of Reinforced Grass Waterways,	W89-02704 5D
covery Systems: Application At Three Hydro-	W89-02859 8A	
geologic Environments in California,	CARBOFURAN	CATALYSTS
W89-02358 5G	Movement of Carbofuran (Nematicide) in Soil	Degradation of Bromoform and Chlorodibromo-
	Columns.	methane in a Catalyzed H2-Water System,
Data on Groundwater Quality for the Walker	W89-03297 5B	W89-03311 2K
Lake One Degree X Two Degree Quadrangle,		CATCHMENT AREAS
Western Nevada and Eastern California,	CARBON	Catchment Experiments in Fluvial Geomorpho-
W89-02541 7C	Change in Distribution Patterns of Photosynthe-	logy.
Central Valley of California,	tically Incorporated C during Phytoplankton	W89-02880 2E
W89-02633 6D	Bloom in Controlled Experimental Ecosystem,	
	W89-03059 2L	Catchment Experiments in Fluvial Geomorpho-
Chemical and Biological Survey of Lakes and	CARBON CYCLE	logy: A Review of Objectives and Methodolo-
Streams Located in the Emerald Lake Water-	Cycling of Methane, Carbon Monoxide, Nitrous	gy,
shed, Sequoia National Park,	Oxide, and Hydroxylamine in a Meromictic,	W89-02881 2E
W89-02852 2H	Coastal Lagoon,	Spatial Variability of Soil Hydrodynamic Prop-
Survey of Sensitivity of Southern California	W89-03191 2L	erties in the Petite Fecht Catchment, Soultzeren,
Lakes to Acid Deposition,	Photosynthetic Carbon Metabolism by Phyto-	France - Preliminary Results,
W89-02864 5C	plankton in a Nitrogen-Limited Reservoir,	W89-02883 2G
	W89-03215 2H	Directors and Directors in the Mannest Ex-
Land Subsidence in the San Joaquin Valley,		Pipeflow and Pipe Erosion in the Maesnant Ex- perimental Catchment,
California, as of 1980,	Methane Cycling in the Sediments of Lake	W89-02884 2E
W89-03018 6G	Washington, W89-03249 2H	W 07-02004
Land Subsidence in the Santa Clara Valley, Cali-	W 69-03249 ZII	Runoff and Sediment Production in a Small
fornia, as of 1982,	CARBON DIOXIDE	Peat-Covered Catchment: Some Preliminary Re-
W89-03019 6G	Modelling a Seasonal Snow Cover,	sults,
	W89-02627 2C	W89-02888 2E
Dendrogeomorphic Evidence and Dating of	CO2-Induced Changes in Seasonal Snow Cover	Hydrology and Water Quality of a Drained Clay
Recent Debris Flows on Mount Shasta, North-	Simulated by the OSU Coupled Atmospheric-	Catchment, Lockle Park, Northumberland,
ern California,	Ocean General Circulation Model,	W89-02889 2E
W89-03028 2J	W89-02629 2C	
Magnitude and Frequency of Debris Flows, and		Water and Sediment Dynamics of the Homerka
Areas of Hazard on Mount Shasta, Northern	Potential Impacts of a Scenario of CO2-Induced	Catchment,
California,	Climatic Change on Ontario, Canada, W89-03063 2A	W89-02895 23
W89-03029 2J	W 89-03003	Some Implications of Small Catchment Solute
Gardony of the Fresh County Water Day	Continuous Flow Determination of Carbon Di-	Studies for Geomorphological Research,
Geology of the Fresh Ground-Water Basin of the Central Valley, California, with Texture	oxide in Water by Membrane Separation-Chemi-	W89-02902 2E
Maps and Sections,	luminescent Detection,	
W89-03032 2F	W89-03182 7B	Analysis of Sediment Transport by Debri
	CARBON MONOXIDE	Flows in the Jiangjia Gully, Yunnan, W89-02909 2.
CANADA	Cycling of Methane, Carbon Monoxide, Nitrous	11 07-04/07
Snow Surveying in Canada,	Oxide, and Hydroxylamine in a Meromictic,	River Response to Catchment Conditions,
W89-02614 7B	Coastal Lagoon,	W89-02990 21
Runoff and Sediment Transport Dynamics in	W89-03191 2L	Malana killian Gandor of the Automorphis Automorphis
Canadian Badland Micro-Catchments.	CARBONATE AQUIFERS	Vulnerability Study of the Aubergenville Aqui
W89-02887 2E	Geophysical Logs and Hydrological Data for	fer, W89-03077 51
	Eight Wells in the Coyote Spring Valley Area,	W 67-030//
Potential Impacts of a Scenario of CO2-Induced	Clark and Lincoln Counties, Nevada,	Reversibility of Acidification Shown by Whole
Climatic Change on Ontario, Canada,	W89-02603 4B	Catchment Experiments,
W89-03063 2A		W89-03120 51
Change in Sadimentation Following Diver Di	CARBONATE ROCKS	CATCUMENT DACING
Change in Sedimentation Following River Di- version in the Eastmain Estuary (James Bay),	Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama;	CATCHMENT BASINS Analysis of Sediment Transport by Debri
Canada,	Area 8,	Flows in the Jiangjia Gully, Yunnan,
W89-03186 2J	W89-02564 5B	W89-02909 2
		-

Effect of Impoundment on the Growth of	Sediment Transport in Step-Pool Streams, W89-02448 2J	Aggradation and Degradation of Alluvial Sand Deposits, 1965 to 1986, Colorado River, Grand
Bagrus docmac in Lake Nasser, W89-03143 6G	Design Problems in Gravel-Bed Rivers, Alaska,	Canyon National Park, Arizona, W89-02973 2J
CATION EXCHANGE	W89-02458 2J	CHANNEL SCOUR
Interactions of Sphagnum with Water and Air, W89-02312 2H	Modelling Fluvial Processes in Streams with Gravel Mining,	River Bed Scour and Construction of Stone Riprap Protection,
CAVES	W89-02462 2E	W89-02442 8A
Controls on the Composition of Authigenic Per-		
colation Water in the Burren, Ireland,	Flow Processes and River Channel Morpholo-	CHANNELING
W89-02730 2K	gy. W89-02910 2J	Fish Populations of a Small Lowland Channel- ized River in England Subject to Long-Term
Valley Excavation in the Yorkshire Dales Karst, W89-02742 2F	Experimental Method in Geomorphology, W89-02913 2E	River Maintenance and Management Works, W89-03139 6G
	1107-02713	CHANNELS
Deuterium Isotope Composition of Palaeoinfil-	CHANNEL FLOW	Design of Reinforced Grass Waterways.
tration Waters Trapped in Speleothems, W89-02981 5A	Formulas for Velocity, Sediment Concentration and Suspended Sediment Flux for Steady Uni-	W89-02859 8A
CAVITATION	Directional Pressure-Driven Flow,	CHEMICAL ANALYSES
Calculation of Prototype Cavitation Characteris- tics in Large Bulb Turbines,	W89-02779 2J	Records of Wells, Drillers' Logs, Water Level Measurements, and Chemical Analyses of
W89-03070 8C	CHANNEL MORPHOLOGY	Groundwater in Harris and Galveston Counties,
CERATIUM	Sediment Supply to Upland Streams: Influence on Channel Adjustment,	Texas 1980-84,
Contrasting Diel Patterns of Vertical Migration	W89-02435 2J	W89-02497 7C
in the Dinoflagellate Ceratium hirundinella in	W 07-02-133	CHEMICAL ANALYSIS
Relation to Phosphorus Supply in a North Tem-	Sediment Supply, Movement and Storage in an	Recognizing Petroleum Hydrocarbon Contami-
perate Reservoir, W89-03221 2H	Unstable Gravel-Bed River, W89-02436 2J	nation in the Vadose Zone with Photoionization Detection Scanning of Field Samples,
		W89-02351 5A
CESIUM RADIOISOTOPES Application of Cs-137 Techniques to Problems	Sediment Balance Considerations Linking Long- Term Transport and Channel Processes,	External Quality-Assurance Results for the Na-
of Sediment Redistribution in Sungai Lui Repre- sentative Basin, Selangor, Malaysia: Part I.	W89-02438 2J	tional Atmospheric Deposition Program and Na- tional Trends Network During 1986,
W89-02712 2J	Field Measurements in a Gravel-bed River which Confirm the Theory of White et al.,	W89-02463 7C
CHALK	W89-02446 2J	Metal Speciation: Theory, Analysis and Applica-
Chemical Weathering of the East Yorkshire		tion.
Chalk,	Sediment Transport in Step-Pool Streams,	W89-02640 5B
W89-02731 2K	W89-02448 2J	11 05-02010
CHIANNEL ADMONING		Combining Field Measurements for Speciation
CHANNEL ARMORING Static Armour Layers by Selective Erosion, W89-02439 2J	Energy Dissipation Rate Approach in River Mechanics,	in Non Perturbable Water Samples: Application to the Iron and Sulfide Cycles in a Eutrophic
-	W89-02453 2J	Lake,
Canal Design by an Armouring Process, W89-02441 8A	Extremal Hypotheses Applied to River Regime, W89-02454 2J	W89-02645 5B Comparison of Anodic Stripping Voltammetry
CHANNEL EROSION		Speciation Data with Empirical Model Predic-
Jefferson Barracks Bridge, Movable-Bed Model	Problems of Bed Load Transport in Braided Gravel-Bed Rivers.	tions of pCu, W89-02646 7B
Study, W89-02417 2J	W89-02455 2J	W 89-02040 /B
W89-02417 2J		Measurements of Binding Site Concentrations in
River Dynamics, Flow Regime and Sediment Transport,	Interaction of Bed Load Transport with Bars, W89-02456 2J	Humic Substances, W89-02647 7B
W89-02432 2J		
Sediment Supply to Upland Streams: Influence	Modelling Fluvial Processes in Streams with Gravel Mining,	Chromatographic Approaches to Trace Element Speciation,
on Channel Adjustment,	W89-02462 2E	
W89-02435 2J		
Sediment Supply, Movement and Storage in an	Roughness Coefficients for Densely Vegetated Flood Plains,	W89-02649 5B
Unstable Gravel-Bed River,	W89-02502 2E	
W89-02436 2J	Described to the Control by The Cont	Maryland Synoptic Stream Chemistry Survey:
Sediment Balance Considerations Linking Long- Term Transport and Channel Processes,	Dynamic Control by Topography in Estuaries, W89-02684 2L	Streams Affected By or At Risk from Acidifica-
W89-02438 2J	Experimental Geomorphology (Drainage Net-	tion, W89-02846 5B
Static Armour Layers by Selective Erosion, W89-02439 2J	work, Piedmont and Channel Morphology), W89-02847	Determination of Traces of Thallium in Various
	Flow Processes and River Channel Morpholo-	Matrices, W89-03067 SA
River Bed Scour and Construction of Stone	gy,	
Riprap Protection, W89-02442 8A	W89-02910 2J	Extraction, Clean-up and Group Separation Techniques in Organochlorine Trace Analysis,
Investigation of Sediment Routing by Size Frac-	Influence of Vegetation on Stream Channel	
tions in a Gravel-Bed River,	Processes,	
W89-02444 2J	W89-02911 2J	Continuous Flow Determination of Carbon Di- oxide in Water by Membrane Separation-Chemi-
Field Measurements in a Gravel-bed River	Stream Response to Flash Floods in Upland	
which Confirm the Theory of White et al.,	Scotland,	W89-03182 7E
W89-02446 2J	W89-02912 2E	
	P	Xanthene Dye Chemiluminescence for Determi
Mountain Torrent Erosion, W89-02447 2J	Experimental Method in Geomorphology,	nation of Free Chlorine in Water,
W89-02447 2J	W89-02913 2E	W89-03183 7E

CHEMICAL ANALYSIS

Analysis of Volatile Halogenated Hydrocarbons	CHEMICAL TREATMENT	CHEMISTRY OF PRECIPITATION
on the ppq Scale,	Plating Waste Sludge Metal Recovery,	Sources of Alkalinity in Precambrian Shield Wa-
W89-03301 5A	W89-02395 5D	tersheds Under Natural Conditions and After Fire or Acidification,
CHEMICAL COMPOSITION Partitioning of Trace Metals in Sediments,	Why Not Simplify Wastewater Compliance, W89-02397 5D	W89-02313 2G
W89-02649 5B	W 89-02397	Stratigraphic Record of Atmospheric Loading
CHEMICAL INDUSTRY	Howard Plating Clean Up Their Act with Mag-	of Metals at the Ombrotrophic Big Heath Bog,
Anaerobic Digestion of Chemical Industry Wastewaters Containing Toxic Compounds by	nesium Hydroxide, W89-02401 5D	Mt. Desert Island, Maine, U.S.A., W89-02315 5B
Downflow Fixed Film Technology.	Pretreatment in Chemical Water and	Metal Treatment and Recovery,
W89-02291 5D	Wastewater Treatment. W89-02791 5G	W89-02653 5D
Treatment of Process Wastewater from Petro-	W89-02/91	Evaluation of Rain Chemistry Data for the John
chemical Plant Using a Rotating Biological Con- tactor - A Case Study,	Chemical Treatment of Flue Gas Washing Liq-	F. Kennedy Space Center, Florida and the Uni-
W89-02292 5D	uids, W89-02809 5D	versity of Central Florida, Orlando, Florida, W89-02708 4C
CHEMICAL OXYGEN DEMAND		
Fate of COD in an Anaerobic System Treating	Coagulation as the First Step in Wastewater Treatment,	CHEMISTRY OF PRECIPITION Effects of Atmospheric Pollutants on Forests,
High Sulphate Bearing Wastewater,	W89-02811 5D	Wetlands and Agricultural Ecosystems.
W89-02295 5D		W89-02304 5B
CHEMICAL PRECIPITATION	Chemically Supported Oil and Grease Removal in Municipal Wastewater Treatment Plants,	CHESAPEAKE BAY
Why Not Simplify Wastewater Compliance,	W89-02813 5D	Multidecade Trend-Monitoring Program for
W89-02397 5D	Charital Biological Treatment sussess Charried	Chesapeake Bay, A Temperate East Coast Estu-
Metal Finishing Wastewater Treatment Upgrade	Chemical-Biological Treatment versus Chemical Treatment: A Case Study,	ary, W89-02324 7A
with an Insoluble Sulfide Precipitation Process,	W89-02814 5D	
W89-02402 5D	Influence of Sludge from Chemical Biological	Estuarine Invertebrates and Fish: Sampling Design and Constraints for Long-Term Meas-
Pre-Precipitation for Improvement of Nitrogen	Influence of Sludge from Chemical Biological Wastewater Treatment on Nitrification and Di-	urements of Population Dynamics,
Removal in Biological Wastewater Treatment, W89-02812 5D	gestion,	W89-02327 2L
	W89-02816 5D	Ground Water and Agriculture: Addressing the
CHEMICAL PROPERTIES Interactions of Sphagnum with Water and Air,	Treatment of Rome Raw Water by Krofta Sand-	Information Needs of Pennsylvania's Chesa-
W89-02312 2H	float Process System - Project Documentation	peake Bay Program, W89-02680 5G
O Fr of Co. of Blanch of Brown Blanch	(Part A), W89-02941 5F	W 85-02080
Quality of Ground Water in the Payette River Basin, Idaho,		Oceanography of Chesapeake Bay,
W89-03008 5G	Treatment of Rome Raw Water by Krofta Sand-	W89-02693 2L
Hydrology and Chemistry of Selected Prairie	float Process System - Project Documentation (Part C),	Water Quality Assessment of DOD Installa- tions/Facilities in the Chesapeake Bay Region.
Wetlands in the Cottonwood Lake Area, Stuts- man County, North Dakota, 1979-82,	W89-02943 5F	Phase III Report. Volume 1 - Summary.
W89-03035 2H	Development of an Innovative and Cost-Effec-	W89-02953 5C
CHEMICAL REACTIONS	tive Municipal-Industrial Waste Treatment System,	Water Quality Assessment of DOD Installa-
Metal Speciation: Theory, Analysis and Applica-	W89-02960 5D	tions/Facilities in the Chesapeake Bay Region.
tion.	New Disinfection A cents for Water	Phase III Report. Volume 2 - Overall Approach, Findings and Recommendations.
W89-02640 5B	New Disinfection Agents for Water, W89-02970 5F	W89-02954 5C
Thermodynamic Calculations with Special Ref-		Iodine Speciation in Chesapeake Bay Waters,
erence to the Aqueous Aluminum System, W89-02641 2K	CHEMICAL WASTES Influence of Cosolvents on Quinoline Sorption	W89-03277 2L
	by Subsurface Materials and Clays,	CHILE
Coordination Chemistry at the Solid/Solution Interface,	W89-03040 5B	Residual Strength of Sand From Dam Failures
W89-02642 5B	CHEMICAL WASTEWATER	in the Chilean Earthquake of March 3, 1985,
Introduction to Interactions of Organic Com-	Industrial Wastewater Pretreatment of a Dental-	W89-02851 8D
pounds with Mineral Surfaces,	Pharmaceutical Company, W89-02805 5D	CHILKAT RIVER
W89-02643 5B	W89-02805 5D	Hydrologic Reconnaissance of the Chilkat River Basin, Southeast Alaska (with Special Reference
Reactions and Transport of Trace Metals in	Evaluation of Biological Treatment of Pharma-	to the Bald Eagle Critical Habitat at the Tsirku
Groundwater,	ceutical Wastewater with PAC Addition. Volume I,	River Alluvial Fan),
W89-02644 5B	W89-02948 5D	W89-02565 2E
Measurements of Binding Site Concentrations in	Evaluation of Biological Treatment of Pharma	CHINA
Humic Substances,	Evaluation of Biological Treatment of Pharma- ceutical Wastewater with PAC Addition.	Development and Achievements of Hydrogeo-
W89-02647 7B	Volume II - Appendices,	logical Mapping in China, W89-02370 2F
Degradation of Bromoform and Chlorodibromo-	W89-02949 5D	
methane in a Catalyzed H2-Water System, W89-03311 2K	CHEMICAL WEATHERING	Groundwater in China, W89-02371 2F
	Chemical Erosion in Tower Karst Terrain,	
CHEMICAL RECOVERY Metal Treatment and Recovery,	Kinta Valley, Peninsular Malaysia, W89-02738 2J	Relationships between Snow Cover and Tem- perature in the Lower Troposphere, General
W89-02653 5D		Circulation in East Asia and Precipitation in
CHEMICAL SLUDGE	CHEMILUMINESCENCE	China,
Reuse of Chemical Sludge for Conditioning of	Continuous Flow Determination of Carbon Di- oxide in Water by Membrane Separation-Chemi-	W89-02609 2C
Biological Sludges,	luminescent Detection,	Distribution of Snow Cover in China,
W89-02815 5D	W89-03182 7B	W89-02613 2C

Water Quality Problems and Control Strategies for the Water Supply of Tianjin City, W89-02794 5F	CHROMIUM Ultra-Trace-Level Determination of Cobalt, Chromium, and Hydrogen Peroxide by Luminol	Superfund Record of Decision: Katonah Municipal Well, NY. W89-02979 5G
Analysis of Sediment Transport by Debris Flows in the Jiangjia Gully, Yunnan,	Chemiluminescence Detected With a Charge- Coupled Device, W89-03181 7B	Superfund Record of Decision: Endicott Well Field, NY.
W89-02909 2J	CHRYSOPHYTA	W89-02983 5G
CHLORIDES Selected Water-Quality Data for the Murtaugh Lake Area, South Central Idaho, June 1987,	Scaled Chrysophytes (Chrysophyceae) as Indi- cators of pH in Sudbury, Ontario, Lakes, W89-03227 5A	Superfund Record of Decision: Vega Alta, PR. W89-02984 5G
W89-02530 7C	CLAMS	Promising Technologies for the Biological De- toxification of Hazardous Waste,
Ambient Water Quality Criteria for Chloride - 1988, W89-02860 5G	Distribution of Contaminants in Clams and Sedi- ments from the Huron-Erie Corridor: II. Lead and Cadmium,	W89-03322 5D CLIMATES
Groundwater Contamination by Nitrates and Chlorides Washed out from Phosphorite Ores in	W89-03177 5B CLARK FORK RIVER	Hydrology of Area 59, Northern Great Plains and Rocky Mountain Coal Provinces, Colorado
the Negev Desert, Israel, W89-03147 5B	Water Quality Data (July 1986 Through September 1987) and Statistical Summaries (March	and Wyoming, W89-02501 2E
CHLORINATED HYDROCARBONS	1985 Through September 1987) for the Clark Fork and Selected Tributaries from Deer Lodge	Effect of Climate on Development of Two Sphagnum Bogs in South-Central Wisconsin,
Random Survey of VOC's, Pesticides and Inorganics in Arizona's Drinking Water Wells, W89-02344 5A	to Missoula, Montana, W89-02566 5B	W89-03293 2H
Use of Well Packers To Control TCE and PCE Contaminants,	CLAY Influence of Cosolvents on Quinoline Sorption	Influence of Potential Evaporation on the Varia- bilities of Simulated Soil Wetness and Climate, W89-03308 2D
W89-02356 5G	by Subsurface Materials and Clays, W89-03040 5B	CLIMATIC DATA
Extraction, Clean-up and Group Separation	CLAYS	Vegetation and Climates of the Last 45,000
Techniques in Organochlorine Trace Analysis, W89-03068 5A	Hydrology and Water Quality of a Drained Clay Catchment, Lockle Park, Northumberland,	Years in the Vicinity of the Nevada Test Site, South-Central Nevada, W89-03024 7C
Biological Degradation of Volatile Chlorinated	W89-02889 2E	CLIMATOLOGY
Hydrocarbons in Groundwater, W89-03081 5B	CLEAN AIR ACT Liability for Managing Hazardous Wastes: Past,	Snow Watch '85.
Pilot Plant Demonstration of In-situ Biodegrada-	Present and Future, W89-02398 6E	W89-02606 2C
tion of 1,1,1-Trichloroethane,		Relationship Between Snow Cover and Atmos-
W89-03164 5D	CLEAN WATER ACT Implications of the Clean Water Act and Safe	pheric Thermal and Circulation Anomalies, W89-02608 2C
CHLORINATION In Vitro Genotoxicity of Chlorinated Drinking	Drinking Water Act Legislation for Southwest- ern Indian Tribes: Water-Quality Management	Soot from Arctic Haze: Radiative Effects on the
Water Processed from Humus-Rich Surface Water,	and Indian Self Determination, W89-02334 5G	Arctic Snowpack, W89-02611 2C
W89-03202 5C	CLEANUP	Snow Surveying in Canada,
CHLORINE Xanthene Dye Chemiluminescence for Determi-	In-Situ Hydrocarbon Extraction, A Case Study, W89-02354 5G	W89-02614 7E Snow Cover in Real Time Monitoring,
nation of Free Chlorine in Water, W89-03183 7B	In Situ Biological Treatment of Hazardous Waste-Contaminated Soils,	W89-02615 20
Chlorine Sensitivity of Early Life Stages of Freshwater Fish,	W89-02923 5D Biodegradation Modeling at Aviation Fuel Spill	Effects of Snow Cover and Tropical Forcing or Mid-Latitude Monthly Mean Circulation,
W89-03333 5C	Site,	W89-02625 2C
CHLOROPHENOLS Photodecomposition of Chlorophenols in Aque-	W89-03100 5G	Parameterization of Snow Albedo for Climate Models,
ous Medium in Presence of Hydrogen Peroxide, W89-03200 5B	Pilot Plant Demonstration of In-situ Biodegrada- tion of 1,1,1-Trichloroethane, W89-03164 5D	W89-02626 70
CHLOROPHYLL	CLEANUP OPERATIONS	Modelling a Seasonal Snow Cover, W89-02627 20
SPREX Hydrographic Data Report, Volume 3 - Chlorophyll and Nutrients, W89-03323 2L	How Clean Is Clean. (What Constitutes the Clean Closure of a Hazardous Waste Land Man-	Characteristics of Seasonal Snow Cover as Simulated by GFDL Climate Models.
	agement Facility), W89-02399 5E	W89-02628 20
CHLOROPHYLL A Comparison of In Situ Estimates of Chlorophyll		CO2-Induced Changes in Seasonal Snow Cove
a Obtained with Whatman GF/F and GF/C Glass-Fiber Filters in Mesotrophic to Hypereu- tophic Lakes,	Waste Water Reduction in Metal Fabrications Operations, W89-02405 5D	Simulated by the OSU Coupled Atmospheric Ocean General Circulation Model, W89-02629 20
W89-03217 7B	Superfund Record of Decision: Distler Farm,	
CHLORPHYTA Effect of pH on Iron and Manganese Uptake by	KÝ. W89-02778 5G	Tropical and Monsoonal Studies, W89-02968 21
a Green Alga, W89-03246 5C	Superfund Record of Decision: Northern Engraving, WI.	Eurasian Snow Cover and Seasonal Forecast of Indian Summer Monsoon Rainfall,
CHROMATOGRAPHY	W89-02938 5B	W89-03054 2
Chromatographic Approaches to Trace Element Speciation,	Oil Spill Combat in the Arctic - An Alternative Approach,	Potential Impacts of a Scenario of CO2-Induce Climatic Change on Ontario, Canada,
W89-02648 5A	W89-02966 5G	W89-03063 2/
New Porous Polymer for Off-Line Preconcentration of Chlorophenols from Water,	Superfund Record of Decision: Kane and Lombard, MD.	Nimbus-7 Global Cloud Climatology: Part 1 Algorithms and Validation,
W89-03286 5A	W89-02977 5E	W89-03307 2

CLINCH RIVER

Effects of Aeration and Minimum Flow En-	Hydrology of Area 27, Eastern Region, Interior	Methods in Narragansett Bay, Long Island
hancement on the Biota of Norris Tailwater, W89-02826 5G	Coal Province, Illinois, W89-02484 5B	Sound and New York Bight, and a General Monitoring Strategy,
	Hydrology of Area 40, Western Region, Interior	W89-02325 5A
CLOGGING Clogging Problems in Groundwater Heat Pump Systems in Sweden,	Coal Province, Kansas, Oklahoma and Missouri, W89-02488 4C	Change in Distribution Patterns of Photosynthe- tically Incorporated C during Phytoplankton
W89-03089 2F	Methods for Hydrologic Monitoring of Surface	Bloom in Controlled Experimental Ecosystem,
CT OUD LIQUID WATER	Mining in the Central-Western United States,	W89-03059 2L
CLOUD LIQUID WATER Consequences of Cloud Water Deposition on	W89-02490 7A	Cycling of Methane, Carbon Monoxide, Nitrous
Vegetation at High Elevation,	Hydrology of Area 31, Eastern Region, Interior	Oxide, and Hydroxylamine in a Meromictic,
W89-02305 5B	Coal Province, Illinois and Indiana, W89-02508 5B	Coastal Lagoon, W89-03191 2L
CLOUD SEEDING Estimate of Precipitation Enhancement Potential	Groundwater Occurrence and Flow Pattern in	Temporal Variations in Dissolved and Particu-
for the Duero Basin of Spain, W89-03306 3B	the Enugu Coal-Mine Area, Anambra State, Ni- geria,	late Aluminum During a Spring Bloom, W89-03192 2L
	W89-03051 2F	
CLOUDS Cumulus and Thunderstorm Initiation by Moun-	COAL MINING	Physiological Disturbances in Fish Living in
tains.	Recovery of Moisture/Solute Profiles in Re-	Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents,
W89-02787 2B	claimed Coal-Mine Spoil, Northwest New Mexico,	W89-03234 5C
CLOUDS COVER	W89-02360 2F	Denitrification in Freshwater and Coastal
Nimbus-7 Global Cloud Climatology: Part I.	Hydrology of Area 62, Northern Great Plains	Marine Ecosystems: Ecological and Geochemi-
Algorithms and Validation, W89-03307 2B	and Rocky Mountain Coal Provinces-New Mexico and Arizona,	cal Significance, W89-03256 2H
COAGULANT INJECTION	W89-02498 2F	
New Coagulant Injection Process,		Factors Controlling the Biogeochemical Cycles of Trace Elements in Fresh and Coastal Marine
W89-02798 5F	Hydrology of Area 59, Northern Great Plains and Rocky Mountain Coal Provinces, Colorado	Waters as Revealed by Artificial Radioisotopes,
COAGULATION	and Wyoming,	W89-03263 2H
Humic Substances Removal by Alum Coagula-	W89-02501 2F.	Physical Energy Inputs and the Comparative
tion: Direct Filtration at Low pH, W89-02795 5F	Hydrology of Area 8, Eastern Coal Province, West Virginia and Ohio,	Ecology of Lake and Marine Ecosystems, W89-03272 2A
New Coagulant Injection Process,	W89-02598 4C	W 07-032/2
W89-02798 5F	Results of Experiments Related to Contact of	SPREX Hydrographic Data Report, Volume 3
Coagulation as the First Step in Wastewater	Mine-Spoils Water with Coal, West Decker and	Chlorophyll and Nutrients, W89-03323 2L
Treatment,	Big Sky Mines, Southeastern Montana, W89-03001 5B	COLORIA PONING
W89-02811 5D		COASTAL ZONES Hydrogeological Mapping in Coastal Areas,
Evaluation of Sodium Aluminate as a Coagulant for Cost Savings at Water Treatment Plants,	COAL MINING IMPACT Hydrology of the White Tail Butte Area, Northern Campbell County, Wyoming,	W89-02390 2F
W89-02959 5F	W89-02596 4C	COASTS
COAL	COASTAL AQUIFERS	Biological Surveys of Estuaries and Coasts. W89-02759 7B
Hydrology of Area 27, Eastern Region, Interior	Application of a Transport-Diffusion Model to a	W 69-02/39
Coal Province, Illinois,	Coastal Aquifer Utilizing In situ Measurements	Planning Biological Surveys,
W89-02484 5B	of Dispersivity, W89-03016 2F	W89-02760 7B
Aerobic Treatment of Sewage from Lignite	W 89-03010 2F	Remote Sensing,
(Brown Coal) Processing,	Groundwater Flow through a Miliolite Lime-	W89-02761 7B
W89-02915 5D	stone Aquifer, W89-03050 2F	C. l. M
COAL AQUIFERS		Salt Marshes, W89-02762 7B
Results of Experiments Related to Contact of	COASTAL GEOMORPHOLOGY	1107-02/02
Mine-Spoils Water with Coal, West Decker and Big Sky Mines, Southeastern Montana,	Coastal Lagoons of East Anglia, U.K., W89-03184 2L	Processing Sediment Macrofauna Samples, W89-02765 7B
W89-03001 5B	COASTAL MARSHES	W 89-02/63
COAL HYDROLOGY	Causes of Wetland Loss in the Coastal Central	Intertidal Rock,
Hydrology of Area 27, Eastern Region, Interior	Gulf of Mexico. Volume 3. Appendices.	W89-02767 2L
Coal Province, Illinois,	W89-02879 4C	Birds,
W89-02484 5B	Coastal Lagoons of East Anglia, U.K.,	W89-02772 2L
Hydrology of Area 31, Eastern Region, Interior	W89-03184 2L	COBALT
Coal Province, Illinois and Indiana, W89-02508 5B	Hurricane-Induced Sediment Deposition in a	Ultra-Trace-Level Determination of Cobalt
	Gulf Coast Marsh, W89-03193 2J	Chromium, and Hydrogen Peroxide by Luminol Chemiluminescence Detected With a Charge-
Hydrology of the White Tail Butte Area, North- ern Campbell County, Wyoming,	COASTAL PLAIN	Coupled Device,
W89-02596 4C	Selected Geohydrologic Characteristics of the	W89-03181 7E
Hydrology of Area 8, Eastern Coal Province,	Patapsco Aquifer at Chalk Point, Prince Georges County, Maryland,	COLD REGIONS
West Virginia and Ohio,	W89-02560 2F	Oil Spill Combat in the Arctic - An Alternative
W89-02598 4C		Approach, W89-02966 50
COAL LIQUEFACTION	COASTAL WATERS Monitoring, Research, and Management: Inte-	W 07-02700 3C
Pilot-Scale Anaerobic Biomass Acclimation	gration for Decisionmaking in Coastal Marine	COLLOIDS
Studies with a Coal Liquefaction Wastewater, W89-02297 5D		Characterization of Colloids in Groundwater W89-02998
30	Jr values	

COLORADO	Aggradation and Degradation of Alluvial Sand	flow, Water Quality, and Water-Supply Oper-
Design and Construction of a Subsurface Gaso- line Recovery System Westminster, Colorado,	Deposits, 1965 to 1986, Colorado River, Grand Canyon National Park, Arizona,	ations in a River Basin, W89-02600 7C
W89-02357 5G	W89-02973 2J	Assessment of Empirical Methodologies for Pre-
Case Study of Minimum Streamflow for Fishery	COLORADO RIVER BASIN Water Resources of the Upper Colorado River	dicting Ground Water Pollution from Agricul- tural Chemicals,
Habitat in the Yampa River, W89-02460 2J	Basin: Problems and Policy Alternatives,	W89-02670 5B
Fiscal Year 1986 Program Report (Colorado	W89-02635 6D	Computer Modelling of Confined Aquifer Sys-
Water Resources Research Institute),	COLUMBIA GLACIER	tems for Interpretation of Chemical and Envi-
W89-02477 9D	Bed Topography Inferred From Airborne Radio-Echo Sounding of Columbia Glacier,	ronmental Isotope Data, W89-03015 2F
Hydrology of Area 59, Northern Great Plains	Alaska,	COMPUTER PROGRAMS
and Rocky Mountain Coal Provinces, Colorado and Wyoming,	W89-03022 2C	Documentation for a Digital Computer Model
W89-02501 2E	COLUMBIA PLATEAU Selected Groundwater Information for the Co-	of Nutrient and Dissolved-Oxygen Transport in the Truckee River and Truckee Canal Down-
Water Quality Assessment of Arvada Reservoir,	lumbia Plateau Regional Aquifer System, Washington and Oregon, 1982-1985: Volume I, Geo-	stream from Reno, Nevada,
Denver Metropolitan Area, Colorado, W89-02562 2H	hydrology,	W89-02504 5B
	W89-02572 7C	Analytically-Derived Sensitivities in One-Di- mensional Models of Solute Transport in Porous
Calibration of a Dissolved-Solids Model for the Yampa River Basin Between Steamboat Springs	Selected Groundwater Information for the Co-	Media,
and Maybell, Northwestern Colorado,	lumbia Plateau Regional Aquifer System, Washington and Oregon, 1982-1985: Volume II,	W89-02595 5B
W89-02591 5B	Water Levels,	Peak/Risk/Culvert: A Program to Compute
Surface Water Quality Characteristics in the	W89-02573 7C	Peak Flows, Hydrologic Risk, and Circular Cul-
Upper North Fork Gunnison River Basin, Colo- rado,	COMBE FILL NORTH	vert Sizes at Forest Road Crossings, W89-02831 2E
W89-02593 5B	Superfund Record of Decision: Combe Fill North Landfill, NJ.	Computer Aided Design of Diffused Aeration
Relations of Specific Conductance to Stream-	W89-02707 5G	Systems,
flow and Selected Water Quality Characteristics	COMBINED-SEWER OVERFLOWS	W89-02947 5D
of the Arkansas River Basin, Colorado,	Data-Collection Methods and Data Summary	CONCRETE
W89-02599 2K	for the Assessment of Water Quality in Cedar Creek, West-Central Illinois,	Review of the State of the Art for Underwater Repair Using Abrasion-Resistant Concrete.
Sediment-Data Sources and Estimated Annual Suspended-Sediment Loads of Rivers and	W89-02520 7B	W89-02781 8F
Streams in Colorado, W89-02604 2J	COMBINED TREATMENT	CONCRETE TECHNOLOGY
	Unit Process Tradeoffs for Combined Trickling Filter and Activated Sludge Processes,	Review of the State of the Art for Underwater Repair Using Abrasion-Resistant Concrete.
Conjunctive Use of Surface and Ground Water in the South Platte, River Basin: A Case Study	W89-03160 5D	W89-02781 8F
of the Central Colorado Water Conservancy District,	COMBUSTION Municipal Westernates Shades Combustion	CONDUIT PRESSURE
W89-02659 6D	Municipal Wastewater Sludge Combustion Technology.	Air Demand and Conduit Pressures, Stillhouse Hollow Dam, Lampasas River, Texas,
Evaluation of Baseline Conditions at Lease	W89-02872 5D	W89-02415 8B
Tract C-a, Rio Blanco County, Colorado,	COMPOSTING	CONFERENCES
W89-02974 5B	Composting of Municipal Wastewater Sludges. W89-02855 5D	Proceedings of the FOCUS Conference on
Hydrology, Geomorphology, and Dam-Break		Southwestern Ground Water Issues. W89-02331 2F
Modeling of the July 15, 1982, Lawn Lake Dam and Cascade Lake Dam Failures, Larimer	COMPUTER AIDED DESIGN Computer Aided Design of Diffused Aeration	31
County, Colorado,	Systems,	8th AESF/EPA Conference on Pollution Con- trol for the Metal Finishing Industry.
W89-03027 8A	W89-02947 5D	W89-02392 5G
Summary of the High Plains Regional Aquifer-	COMPUTER MODEL	CONFINED AQUIFERS
System Analysis in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South	Predicting Chemical Movement in Soils, W89-02473 5B	Computer Modelling of Confined Aquifer Sys-
Dakota, Texas, and Wyoming,		tems for Interpretation of Chemical and Envi- ronmental Isotope Data,
W89-03030 2F	COMPUTER MODELS Numerical Model for the Computation of Radi-	W89-03015 2F
Effects of Future Ground-Water Pumpage on	ance Distributions in Natural Waters with Wind- Roughened Surfaces, Part II: User's Guide and	CONJUNCTIVE USE
the High Plains Aquifer in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma,	Code Listing,	Conjunctive Use of Surface and Ground Water in the South Platte, River Basin: A Case Study
South Dakota, Texas, and Wyoming,	W89-02414 2H	of the Central Colorado Water Conservancy
W89-03031 2F	Assessment of Water Quality and Factors Af-	District,
Runoff Characteristics and Washoff Loads from	fecting Dissolved Oxygen in the Sangamon River, Decatur to Riverton, Illinois, Summer	W89-02659 6D
Rainfall-Simulation Experiments on a Street Sur- face and a Native Pasture in the Denver Metro-	1982,	CONNECTICUT Contribution of Toxic Chemicals to Groundwat-
politan Area, Colorado,	W89-02486 5B	er for Domestic On-Site Sewage Disposal Sys-
W89-03036 2E	Advisory System for North Caronna Ground	tems, W89-02584 5B
COLORADO RIVER	water Quality Modeling and Management Needs,	11.1
Hydrologic Data for Urban Studies in the Austin Metropolitan Area, Texas, 1986,	W89-02548 5G	New Haven Harbor Numerical Model Study, W89-02874 6G
W89-02597 4C		
Effects of Steady versus Fluctuating Flows on	Farm Irrigation Systems Planning,	CONSERVATION Lake Erie Conservation Tillage Demonstration
Aquatic Macroinvertebrates in the Colorado	1107-02550	Projects: Evaluating Management of Pesticides,
River below Glen Canyon Dam, Arizona, W89-02940 6G	Computer-Program Documentation of an Inter- active-Accounting Model to Simulate Stream-	Fertilizer, Residue to Improve Water Quality. W89-02837 3F
	The state of the s	

Conservation Aims, Criteria, and Goals for Engineering/Cost Evaluation of Options for Re-

CONSERVATION

Rivers,	moval/Disposal of NC Pines,	Effects of Cadmium Exposure on Feeding of
W89-02987 2H	W89-02933 5D	Freshwater Planktonic Crustaceans,
CONSERVATION TILLAGE	Membrane Separation Technologies for Treat-	W89-03288 5C
Final Report: Lake Erie Conservation Tillage	ment of Hazardous Wastes,	CULVERTS
Demonstration Projects.	W89-03284 5D	Peak/Risk/Culvert: A Program to Compute
W89-02835 3F	COST BENEFIT ANALYSIS	Peak Flows, Hydrologic Risk, and Circular Cul-
	COST-BENEFIT ANALYSIS Social Choice and Benefit-Cost Analysis,	vert Sizes at Forest Road Crossings,
Lake Erie Conservation Tillage Demonstration	W89-02756 6B	W89-02831 2E
Projects: Evaluating Management of Pesticides, Fertilizer, Residue to Improve Water Quality.	W 87-02130	
W89-02837 3F	Definite Project Report for Section 14. Emer-	CYANOGENIC
1107 02007	gency Streambank Protection, Sangamon River	Anoxic/Oxic Activated Sludge Treatment of
CONSTRUCTION COSTS	Sewage Treatment Facility, Riverton, Illinois.	Cyanogens and Ammonia in the Presence of Phenols,
Value Engineering for Small Communities.	W89-02934 4D	W89-02298 5D
W89-02865 6B	COSTS	W 65-02256
CONSTRUCTION METHODS	Technologies and Costs for the Treatment of	CYANOPHYTA
Jefferson Barracks Bridge, Movable-Bed Model	Microbial Contaminants in Potable Water Sup-	Effects of the Blue-Green Alga Microcystis Aer-
Study,	plies.	uginosa on Zooplankton Competitive Relations,
W89-02417 2J	W89-02412 5F	W89-03118 2H
CONSTRUCTION PROJECTS	Evaluation of Sodium Aluminate as a Coagulant	Effect of Assam Crude on Photosynthesis and
Effects on Suspended and Substrate Sediments	for Cost Savings at Water Treatment Plants,	Associated Electron Transport System in Ana-
in Two Streams Resulting from Different Gas-	W89-02959 5F	baena doliolum,
Pipeline Installation Techniques,		W89-03207 5C
W89-02823 4C	Development of an Innovative and Cost-Effec-	
	tive Municipal-Industrial Waste Treatment	CYCLING NUTRIENTS
CONSUMPTIVE USE	System, W89-02960 5D	Prediction of Phosphorus Release Rates from
Evapotranspiration of Phreatophytes in the San	30	Total and Reductant-Soluble Phosphorus in
Luis Valley, Colorado,	CRANBERRIES	Anoxic Lake Sediments,
W89-02478 2D	Characteristics of the Sorption of Chlorothalonil	W89-03210 2H
Evapotranspiration of Native Vegetation in the	and Azinphos-Methyl to a Soil from a Commer-	Silica and Phosphorus Flux from Sediments: Im-
Closed Basin of the San Luis Valley, Colorado,	cial Cranberry Bog,	portance of Internal Recycling in Lake Michi-
W89-02481 2D	W89-03195 5B	gan,
COLUMN COM BURNO	CRATER LAKE	W89-03219 2H
CONTACT BEDS	Review of the Crater Lake Limnological Pro-	
Comparison Between Waste Water Treatment in Completely Mixed and Fluidized Bed Reactors:	grams,	Contrasting Diel Patterns of Vertical Migration
Development and Structure of Biomass (Verg-	W89-02322 2H	in the Dinoflagellate Ceratium hirundinella in
leich der Absasserreinigung im Ruhr - und im	CRATER LAKE NATIONAL PARK	Relation to Phosphorus Supply in a North Tem- perate Reservoir,
Wirbelbettreaktor Sowie Entwicklung und	Review of the Crater Lake Limnological Pro-	W89-03221 2H
Struktur der Biomasse),	grams,	W 69-03221 2H
W89-03045 5D	W89-02322 2H	Sediment Record of Biogeochemical Responses
CONVECTIVE PRECIPITATION		to Anthropogenic Perturbations of Nutrient
Oklahoma-Kansas Mesoscale Convective	CRAYFISH	Cycles in Lake Ontario,
System of 10-11 June 1985: Precipitation Struc-	In Vivo and In Vitro Effect of Triclorfon on	W89-03222 2H
ture and Single-Doppler Radar Analysis,	Esterases of the Red Crayfish Procambarus clar- kii,	Dynamics of Lake Michigan Phytoplankton: Re-
W89-03273 2B	W89-03314 5C	lationship to Nitrogen and Silica Fluxes,
COPPER		W89-03230 2H
Comparison of Anodic Stripping Voltammetry	CROP PRODUCTION	
Speciation Data with Empirical Model Predic-	Water Conservation for More Crop Production	Phosphorous Flux from Lake Sediments: Effect
tions of pCu,	in the Great Plains,	of Epipelic Algal Oxygen Production,
W89-02646 7B	W89-02657 3F	W89-03248 2H
	Efficient Nitrogen Fertilization in Agricultural	Methane Cycling in the Sediments of Lake
Growth, Fecundity, and Energy Stores of White	Production Systems,	Washington,
Sucker (Catostomus commersoni) from Lakes	W89-02665 5B	W89-03249 2H
Containing Elevated Levels of Copper and Zinc, W89-03225 5C		
# 69-03223 3C	CROP YIELD	Nitrogen Fixation in Freshwater, Estuarine, and
Copper Intoxication in Chinook Salmon (Oncor-	Model for Predicting the Effect of Drainage on Soil Moisture, Soil Temperature and Crop Yield,	Marine Ecosystems: 1. Rates and Importance,
hynchus Tshawystscha) Induced by Natural	W89-03334 4A	W89-03254 2H
Springwater: Effects on Gill Na(+), K(+)-	110,00001	Nitrogen Fixation in Freshwater, Estuarine, and
ATPase, and Plasma Glucose,	CROPLAND	Marine Ecosystems: 2. Biogeochemical Con-
W89-03228 5C	Saline Seep on Wheatland in Northwest Oklaho-	trols,
Chronic Effects of Cu on Reproduction of Poly-	ma,	W89-03255 2H
pedilum nubifer (Chironomidae) through Water	W89-02672 5B	
and Food,	CRUDE OIL	Denitrification in Freshwater and Coastal
W89-03296 5C	Sensitivity of Branchial Mucus to Crude Oil	Marine Ecosystems: Ecological and Geochemi-
CORE LOGGING	Toxicity in a Freshwater Fish, Colisa fasciatus,	cal Significance, W89-03256 2H
New Biological Marker Layer in the Sediments	W89-03204 5C	W 03-03230 2H
of the Great Lakes: Bythothrephes cederstroemi		CYCLONES
(Schodler) Spines,	Cirral Beat Frequency in Balanus balanoides,	Snow Cover, Cyclogenesis and Cyclone Trajec-
W89-03178 2H		tories,
COST ANALYSIS		W89-02607 2C
COST ANALYSIS	Effect of Assam Crude on Photosynthesis and	Relationship Returned Communication
Optimizing Operation and Maintenance of Water Supply Wells,	Associated Electron Transport System in Ana- baena doliolum.	Relationship Between Snow Cover and Atmos- pheric Thermal and Circulation Anomalies,
W89-02333 6B		W89-02608 2C
OL.	30	

ZECHOSLOVAKIA Problems in Czechoslovakia Regarding Methods of Removal of Nitrates from Drinking Water,	National Surface Water Survey, Western Lake Survey (Phase I Synoptic Chemistry) Quality Assurance Plan,	Estuarine Invertebrates and Fish: Sampling Design and Constraints for Long-Term Meas- urements of Population Dynamics,
W89-03098 5D	W89-02413 2H	W89-02327 2L
DAM EFFECTS Limnological and Fishery Studies on Lake Sharpe, a Main-stem Missouri River Reservoir, 1964-1975,	Data-Collection Methods and Data Summary for the Assessment of Water Quality in Cedar Creek, West-Central Illinois, W89-02520 7B	Development, Management, and Analysis of a Long-Term Ecological Research Information Base: Example for Marine Macrobenthos, W89-02329 10D
W89-02423 2H	Review of 183 GHz Moisture Profile Retrieval	Hudespelanial Many from the View Brief of
Physical, Chemical, and Biological Characteris- tics of Lake Sharpe, South Dakota, 1966-1975, W89-02424 2H	Studies, W89-02705 7C	Hydrogeological Maps from the View-Point of the User, W89-02391 7A
Zooplankton Biomass Exchange in Lake Sharpe, South Dakota, 1974-1975, W89-02425 2H	Pre-Feasibility on Streamflow Gauging Using Radioisotope Tracer Method for Kemumbu Ag- riculture Development Authority (KADA), W89-02713	DATA COLLECTIONS Water Resources Activities of the U.S. Geological Survey in Missouri, Fiscal Year 1987, W89-02470 9C
Design Problems in Gravel-Bed Rivers, Alaska, W89-02458 2J	Hydrology and Data Acquisition, W89-02726 2A	Directory of Precipitation Monitoring Sites, Na-
Effects of Hydroelectric Scheme on Fluvial Ecosystems within the Spanish Pyrenees, W89-03138 6G	Observation of Stratiform Rain with 94 GHz and S-Band Doppler Radar,	tional Atmospheric Deposition Program/Na- tional Trends Network (NADP/NTN). W89-02480 7A
W 69-03136	W89-02830 2B	Groundwater Resources of Rusk County, Texas,
Role of Riparian Woods in Regulating Nitrogen Fluxes Between the Alluvial Aquifer and Sur- face Water: A Conceptual Model,	Precise Measurement of Microforms and Fabric of Alluvial Cones for Prediction of Landform	W89-02491 2F
W89-03140 6G	Evolution,	Selected Hydrogeologic Data for the Southwest Glendive Preliminary Logical Mining Unit and
Radial Stem Growth of Coniferous Trees near	W89-02908 2J	Adjacent Areas, Dawson County, Montana,
Swedish Reservoirs,	Development and Field Use of a Snow Collec-	W89-02531 7C
W89-03142 6G Effect of Impoundment on the Growth of	tor for Acid Precipitation Studies, W89-02945 5B	Hydrologic Reconnaissance of the Chilkat River Basin, Southeast Alaska (with Special Reference
Bagrus docmac in Lake Nasser, W89-03143 6G	Design of the Primary Pre-TRMM and TRMM Ground Truth Site,	to the Bald Eagle Critical Habitat at the Tsirku River Alluvial Fan),
DAM FAILURE	W89-02971 7A	W89-02565 2E
Sediment Supply, Movement and Storage in an Unstable Gravel-Bed River,	Monitoring and Surveillance, W89-02991 7B	Methods for Collection and Analysis of Aquatic Biological and Microbiological Samples,
W89-02436 2J	Role of Tracer Methods in Hydrology as a	W89-02568 7B
Residual Strength of Sand From Dam Failures in the Chilean Earthquake of March 3, 1985, W89-02851 8D	Source of Physical Information: Basic Concepts and Definitions, Time Relationship in Dynamic Systems,	Water Resources Activities of the U. S. Geologi- cal Survey in Texas - Fiscal Year 1987, W89-02574 9C
Hydrology, Geomorphology, and Dam-Break	W89-03010 7B	
Modeling of the July 15, 1982, Lawn Lake Dam and Cascade Lake Dam Failures, Larimer County, Colorado,	Surface Topography of the Lower Part of Co- lumbia Glacier, Alaska, 1974-81, W89-03021 2C	U.S. Geological Survey Urban-Stormwater Data Base of Constituent Storm Loads; Characteris- tics of Rainfall, Runoff, and Antecedent Condi-
W89-03027 8A	W 89-03021 2C	tions; and Basin Characteristics, W89-02581 7C
DAMS	Bed Topography Inferred From Airborne	W 85-02381
Air Demand and Conduit Pressures, Stillhouse Hollow Dam, Lampasas River, Texas,	Radio-Echo Sounding of Columbia Glacier, Alaska, W89-03022 2C	Hydrologic Data for Urban Studies in the Austin Metropolitan Area, Texas, 1986,
W89-02415 8B		W89-02597 4C
Discharge Ratings for Control Structures at McHenry Dam on the Fox River, Illinois,	DATA ANALYSIS Satellite Rainfall Retrieval by Logistic Regression,	Water Quality Data for Orwell Reservoir and the Otter Tail River Near Fergus Falls, Minne-
W89-02494 7B	W89-02854 7C	sota, W89-02605 5B
Vibration and Leakage of Weir Gates, W89-03073 8C	DATA COLLECTION New Approaches to Monitoring Aquatic Eco-	Djinnang II: A Facility to Study Mixing in
DAPHNIA	systems.	Stratified Waters, W89-02701 7B
Critical Assessment of the 'Dynamic Daphnia Test' (Kritische Betrachtung des 'Dynamischen	W89-02317 5A Monitoring, Research, and Management: Inte-	Planning Biological Surveys,
Daphnien Tests'), W89-03046 5A	gration for Decisionmaking in Coastal Marine Environments,	W89-02760 7B
Effects of Cadmium on Consumption, Assimila-	W89-02323 5A	Acid Precipitation in North America: 1985 Annual and Seasonal Data Summaries from
tion and Biochemical Parameters of Daphnia magna: Possible Implications for Reproduction, W89-03289 5C	Multidecade Trend-Monitoring Program for Chesapeake Bay, A Temperate East Coast Estu-	Acid Deposition System Data Base, W89-02997 5B
Chronic Effects of Contaminated Sediment on	ary, W89-02324 7A	Vegetation and Climates of the Last 45,000 Years in the Vicinity of the Nevada Test Site,
Daphnia magna and Chironomus tentans, W89-03312 5C	Coastal Monitoring: Evaluation of Monitoring Methods in Narragansett Bay, Long Island	South-Central Nevada, W89-03024 7C
Toxicity of Six Heterocyclic Nitrogen Com-	Sound and New York Bight, and a General	DATA INTERPRETATION
pounds to Daphnia pulex, W89-03315 5C	Monitoring Strategy, W89-02325 5A	Mathematical Modelling, W89-02725 2A
DATA ACQUISITION	'Mussel Watch'Measurements of Chemical Pol-	
Monitoring and Quality Assurance Procedures for the Study of Remote Watershed Ecosystems,	lutants in Bivalves as One Indicator of Coastal Environmental Quality,	Cumulative Impact Assessment: Application of a Methodology,

DATA INTERPRETATION

Satellite Rainfall Retrieval by Logistic Regres-	Magnitude and Frequency of Debris Flows, and Areas of Hazard on Mount Shasta, Northern	Biological Groundwater Denitrification: Labo- ratory Studies,
sion, W89-02854 7C	California,	W89-03096 5F
Design of the Primary Pre-TRMM and TRMM	W89-03029 2J	In Situ Biological Groundwater Denitrification:
Ground Truth Site,	DECISION MAKING	Concepts and Preliminary Field Tests,
W89-02971 7A	Power Behind the Flood Scene,	W89-03097 5G
Acid Precipitation in North America: 1985	W89-02747 6E	Politica in Combanda dia Rossalia Madada
Annual and Seasonal Data Summaries from	DECOMPOSING ORGANIC MATTER	Problems in Czechoslovakia Regarding Methods of Removal of Nitrates from Drinking Water,
Acid Deposition System Data Base, W89-02997 5B	Measurements of Binding Site Concentrations in Humic Substances,	W89-03098 5D
	W89-02647 7B	Kinetics of Low Solids Bio-denitrification of
Mathematical Models for Interpretation of	11.00	Water Supplies,
Tracer Data in Groundwater Hydrology. W89-03009 2F	In Vitro Genotoxicity of Chlorinated Drinking Water Processed from Humus-Rich Surface	W89-03166 5F
General Review of Methodologies and Ap-	Water,	Denitrification in Freshwater and Coastal
proaches in Mathematical Models for Interpreta-	W89-03202 5C	Marine Ecosystems: Ecological and Geochemi-
tion of Tracer Data in Hydrology,	DECONTAMINATION	cal Significance,
W89-03011 2F	Literature Study on the Feasibility of Microbio-	W89-03256 2H
Review of Existing Mathematical Models for	logical Decontamination of Polluted Soils,	DENUDATION
Interpretation of Tracer Data in Hydrology,	W89-02916 5G	Chemical Erosion in Tower Karst Terrain,
W89-03012 2F	In Situ Biological Treatment of Hazardous	Kinta Valley, Peninsular Malaysia,
	Waste-Contaminated Soils,	W89-02738 2J
Computer Modelling of Confined Aquifer Sys-	W89-02923 5D	Patterns of Hillslope Solutional Denudation in
tems for Interpretation of Chemical and Envi- ronmental Isotope Data,		Relation to the Spatial Distribution of Soil Mois-
W89-03015 2F	Pilot Plant Demonstration of In-situ Biodegrada-	ture and Soil Chemistry over a Hillslope Hollow
	tion of 1,1,1-Trichloroethane, W89-03164 5D	and Spur,
Use of Linear Compartmental Simulation Ap-	W89-03104	W89-02906 2J
proach for Quantitative Interpretation of Isotope Data under Time Variant Flow Conditions,	DEEP-BED FILTRATION	DENSIER
W89-03017 7C	Modeling the Effects of Adsorbed Hydrolyzed	DENVER Water Management Issues in the Denver, Colo-
10	Al(III)-Ions on Deep Bed Filtration,	rado, Urban Area,
Monitoring Baseline Suspended Sediment in	W89-02796 5F	W89-02638 6D
Forested Basins: The Effects of Sampling on	DEGRADATION	
Suspended Sediment Rating Curves, W89-03053 2J	Sensitivity Analysis of Adsorption and Degrada-	DEPOSITION
W 69-03033	tion Parameters in the Modeling of Pesticide	Hurricane-Induced Sediment Deposition in a
Interpretation of 'Controlled' vs 'Natural' Ex-	Transport in Soils,	Gulf Coast Marsh, W89-03193 2J
periments in Streams,	W89-03150 2G	W89-03193
W89-03117 7A	Photodegradation of the Lampricide 3-Trifluor-	DESALINATION
DATA RETRIEVAL	omethyl-4-nitrophenol (TFM): 2. Field Confir-	Desalination of Water. Citations from the COM-
Proceedings, Seventeenth Mississippi Water Re-	mation of Direct Photolysis and Persistence of	PENDEX Engineering Information, Inc. Data-
sources Conference, 25-26 March, 1987, Jackson,	Formulation Impurities in a Stream During	base (Dec 83 - Sep 87).
Mississippi.	Treatment, W89-03175 5B	W89-02782 3A
W89-02476 6B	W 65-03173	Using Desalination Technologies for Water
DATA STORAGE	Photodecomposition of Chlorophenols in Aque-	Treatment.
Proceedings, Seventeenth Mississippi Water Re-	ous Medium in Presence of Hydrogen Peroxide,	W89-02849 3A
sources Conference, 25-26 March, 1987, Jackson,	W89-03200 5B	DESERTS
Mississippi. W89-02476 6B	DELAWARE	Bed Load Transport in Desert Floods: Observa-
	Poultry Manure Management and Ground	tions in the Negev,
DATA STORAGE AND RETRIEVAL	Water Quality: The Delaware Solution,	W89-02450 2J
Development, Management, and Analysis of a	W89-02678 5G	
Long-Term Ecological Research Information Base: Example for Marine Macrobenthos,	DELTAS	Great American Desert Transformed: Aridity,
W89-02329 10D	Hurricane-Induced Sediment Deposition in a	Exploitation, and Imperialism in the Making of the Modern American West,
	Gulf Coast Marsh,	W89-02632 6D
DDT	W89-03193 2J	
DDT Residues in Sediments from the Bay of Bengal,	Freshwater and Marine Coupling in Estuaries of	Toward Sustaining a Desert Metropolis: Water
W89-03198 5B	the Mississippi River Deltaic Plain,	and Land Use in Tucson, Arizona,
	W89-03271 2E	W89-02637 6D
DEBRIS	DENDROCKINONOLOGIA	Groundwater Contamination by Nitrates and
Precise Measurement of Microforms and Fabric of Alluvial Cones for Prediction of Landform	DENDROCHRONOLOGY Dendrogeomorphic Evidence and Dating of	Chlorides Washed out from Phosphorite Ores in
Evolution,	Recent Debris Flows on Mount Shasta, North-	the Negev Desert, Israel,
W89-02908 2J	ern California,	W89-03147 5B
	W89-03028 2J	DESIGN CRITERIA
Some Pelationships Patureen Dahais Flour	Radial Stem Growth of Coniferous Trees near	Evaluation of Municipal Solid Waste Landfill
Some Relationships Between Debris Flow Motion and Micro-Topography for the Kamika-	Swedish Reservoirs,	Cover Designs,
mihori Fan, North Japan Alps,	W89-03142 6G	W89-02871 5E
W89-02907 2J		Computer Aided Decim of Differed Association
	DENITRIFICATION	Computer Aided Design of Diffused Aeration Systems,
Analysis of Sediment Transport by Debris Flows in the Jiangjia Gully, Yunnan,	Utilization of Nitrite Oxidation Inhibition to Im- prove the Nitrogen Elimination Process.	W89-02947 5D
W89-02909 2J	W89-02288 5D	
		DESIGN FLOW
Dendrogeomorphic Evidence and Dating of		Peak/Risk/Culvert: A Program to Compute
Recent Debris Flows on Mount Shasta, North- ern California,		Peak Flows, Hydrologic Risk, and Circular Cul- vert Sizes at Forest Road Crossings,
W89-03028 2J	Environments, W89-02359 5G	W89-02831 2E
_	30	

DESIGN STANDARDS	DISCHARGE MEASUREMENTS	DRAINAGE
Rationale for the Design of Monitoring Well	Discharge Ratings for Control Structures at	Catchment Experiments in Fluvial Geomorpho-
Screens and Filter Packs,	McHenry Dam on the Fox River, Illinois,	
W89-03332 5B	W89-02494 7B	logy: A Review of Objectives and Methodolo-
W 89-03332 3B	W 67-02474 /B	gy.
DETENTION PONDS	DISCHARGE RATINGS	W89-02881 2E
Effects of Runoff Controls on the Quantity and	Discharge Ratings for Control Structures at	Model for Predicting the Effect of Drainage on
Quality of Urban Runoff at Two Locations in	McHenry Dam on the Fox River, Illinois,	Soil Moisture, Soil Temperature and Crop Yield,
Austin, Texas,	W89-02494 7B	
W89-02518 5B		W89-03334 4A
W 67-02516	DISINFECTANTS	DRAINAGE AREA
DETENTION RESERVOIRS	Halamine Water Disinfectants,	Stormflow Characteristics of Three Small Lime-
Quantity and Quality of Storm Runoff from	W89-03285 5F	stone Drainage Basins in North Island, New
Three Urban Catchments in Bellevue, Washing-	DISINFECTION	Zealand.
ton,	New Disinfection Agents for Water,	W89-02735 2A
W89-03000 5B	W89-02970 5F	W 89-02133
	W89-02970 SF	DRAINAGE AREAS
DETOXIFICATION	Problems of the Toxicological Compatibility of	Drainage Areas in the James River Basin in
Biological Treatment of Toxic Industrial Waste,	Hydrogen Peroxide in Drinking and Swimming	Eastern South Dakota,
W89-02919 5D	Pool Water for Humans from the Pharmacokine-	W89-02515 7C
	tic and Biochemical Points of View (Probleme	11 05-02515
In Situ Biological Treatment of Hazardous	Der Humantoxikologischen Vertraglichkeit von	DRAINAGE EFFECTS
Waste-Contaminated Soils,	Wasserstoffperoxid in Bade- and Trinkwasser	Hydrology and Water Quality of a Drained Clay
W89-02923 5D	aus Biochemischer und Pharmakokinetischer	Catchment, Lockle Park, Northumberland,
Biological Transformation and Detarification of	Sicht),	W89-02889 2E
Biological Transformation and Detoxification of 7,12-Dimethylbenz(a)anthracene in Soil Systems,	W89-03042 5C	11 07-02007
		DRAINAGE PATTERNS
W89-03161 5B	Studies of Permeation of Gases with Disinfect-	Experimental Geomorphology (Drainage Net-
DETRITUS	ing Action Across Polymer Barriers,	work, Piedmont and Channel Morphology),
Dendrogeomorphic Evidence and Dating of	W89-03044 5F	W89-02847 2J
Recent Debris Flows on Mount Shasta, North-	DISPERSION	
ern California,		DRAINAGE SYSTEMS
W89-03028 2J	Modeling Acid Migration Through Soils, W89-02361 5B	Dry Wells - Solution or Pollution: An Arizona
W 67-03026	W 89-02301 3B	Status Report,
Magnitude and Frequency of Debris Flows, and	Dispersion in Shallow Estuaries,	W89-02338 5B
Areas of Hazard on Mount Shasta, Northern	W89-02685 2L	1107-02330
California.		Behaviour of Buried Small Flexible Pipes,
W89-03029 2J	DISPERSIVITY	W89-03137 8G
	Application of a Transport-Diffusion Model to a	
Production and Use of Detritus in Various	Coastal Aquifer Utilizing In situ Measurements	DRAINAGE WELLS
Freshwater, Estuarine, and Coastal Marine Eco-	of Dispersivity,	Water Quality of Runoff to the Clarksville Me-
systems,	W89-03016 2F	morial Hospital Drainage Well and of Mobley
W89-03266 2H	DISCOLVED OVICEN	Spring, Clarksville, Tennessee, February-March
	DISSOLVED OXYGEN	1988,
DEUTERIUM	Assessment of Water Quality and Factors Af-	W89-02556 5B
Deuterium Isotope Composition of Palaeoinfil-	fecting Dissolved Oxygen in the Sangamon	
tration Waters Trapped in Speleothems,	River, Decatur to Riverton, Illinois, Summer	DREDGING
W89-02981 5A	1982,	Blountstown Reach, Apalachicola River, Mova-
DIFLUBENZURON	W89-02486 5B	ble-Bed Model Study,
	Effects of Aeration and Minimum Flow En-	W89-02416 2J
Diflubenzuron Application to Citrus and Its	hancement on the Biota of Norris Tailwater,	
Impact on Invertebrates in an Adjacent Pond, W89-03208 5C	W89-02826 5G	Consequences of Dredging,
W 89-03208		W89-02700 2L
DIGESTION	Simplified Laboratory Procedures for DO De-	
Influence of Sludge from Chemical Biological	termination (APHA/AWWA/ WPCF Method),	Clam Shell Dredging in Lakes Pontchartrain
Wastewater Treatment on Nitrification and Di-	W89-02958 7B	and Maurepas, Louisiana,
gestion,		W89-02715 6G
W89-02816 5D	Probability Distribution for Critical DO Loca-	Post-in Todaylar of Post-
	tion in Streams,	Dredging: Technology and Environmental As-
DINITROCRESOL	W89-03292 7B	pects. Citations from the Life Sciences Collec-
Fate of 4,6-Dinitro-o-Cresol in Municipal Acti-	DISSOLVED SOLIDS	tion Database (Jan 78 - Aug 87).
vated Sludge Systems,	Humic Substances Removal by Alum Coagula-	W89-02783 2J
W89-02296 5D	tion: Direct Filtration at Low pH,	New Haven Harbor Numerical Model Study,
	W89-02795 5F	
DINOFLAGELLATES	57-04.75	W 87-028/4 0U
Contrasting Diel Patterns of Vertical Migration	DISTLER FARM	DRILLERS LOGS
in the Dinoflagellate Ceratium hirundinella in	Superfund Record of Decision: Distler Farm,	Records of Wells, Drillers' Logs, Water Level
Relation to Phosphorus Supply in a North Tem-	KŸ.	Measurements, and Chemical Analyses of
perate Reservoir,	W89-02778 5G	Groundwater in Harris and Galveston Counties,
W89-03221 2H		Texas 1980-84,
DIRECTORIES	DISTRIBUTION PATTERNS	200
Directory of Precipitation Monitoring Sites, Na-	Modelling Seasonally Freezing Ground Condi-	
tional Atmospheric Deposition Program/Na-	110113	DRINKING WATER
tional Trends Network (NADP/NTN).	W89-03331 2C	Random Survey of VOC's, Pesticides and Inor-
W89-02480 7A	DIVERSION	ganics in Arizona's Drinking Water Wells,
11 07 02 100 /A	Change in Sedimentation Following River Di-	
DISCHARGE	version in the Eastmain Estuary (James Bay),	
Estuarine Residence Times,	Canada.	Use of Well Packers To Control TCE and PCE
W89-02688 2L		Contaminants,
		W89-02356 5G
DISCHARGE COEFFICIENT	DOMESTIC WATER	
Discharge Ratings for Control Structures a		
McHenry Dam on the Fox River, Illinois,	of Piped Water to Anglesey,	tion of Groundwater Supplies,
W89-02494 7E	W89-03041 5F	W89-02586 5F

DRINKING WATER

National Survey of Pesticides in Drinking Water	States of the Lore Term Pollution Menitoring	New Assessher to Manitorina Assetia For
Wells, W89-02656 5B	Strategies for Long-Term Pollution Monitoring of the Coastal Oceans,	New Approaches to Monitoring Aquatic Eco- systems.
W 87-02030	W89-02319 5A	W89-02317 5A
Pretreatment of Drinking Water to Control Or-		W07-02317
ganic Contaminants and Taste and Odor,	Effects of Aeration and Minimum Flow En-	Monitoring the Nation's WatersA New Per-
W89-02793 5F	hancement on the Biota of Norris Tailwater,	spective,
Two Test Procedures for Radon in Drinking	W89-02826 5G	W89-02318 5A
Water: Interlaboratory Collaborative Study,	Effects of Steady versus Fluctuating Flows on	Stantanian for I and Town Bellution Manitoring
W89-02956 5A	Aquatic Macroinvertebrates in the Colorado	Strategies for Long-Term Pollution Monitoring of the Coastal Oceans,
Contraintentian Absorption of Coluble Heaving	River below Glen Canyon Dam, Arizona,	W89-02319 5A
Gastrointestinal Absorption of Soluble Uranium from Drinking Water,	W89-02940 6G	W 67-02317
W89-02957 5B	ECOLOGY	Multidecade Trend-Monitoring Program for
	Chie Steven Besievelinstien Breisst, A Com	Chesapeake Bay, A Temperate East Coast Estu-
Quality of Ground Water in the Payette River	Ohio Stream Regionalization Project: A Com- pendium of Results,	ary,
Basin, Idaho,	W89-02932 2H	W89-02324 7A
W89-03008 5G	W 67-02/32	Estados Installados al Elek Comita
Problems of the Toxicological Compatibility of	Interpretation of 'Controlled' vs 'Natural' Ex-	Estuarine Invertebrates and Fish: Sampling
Hydrogen Peroxide in Drinking and Swimming	periments in Streams,	Design and Constraints for Long-Term Meas- urements of Population Dynamics,
Pool Water for Humans from the Pharmacokine-	W89-03117 7A	W89-02327 2L
tic and Biochemical Points of View (Probleme	Effects of the Blue-Green Alga Microcystis Aer-	W 65-02321
Der Humantoxikologischen Vertraglichkeit von	uginosa on Zooplankton Competitive Relations,	Gas Chromatographic Residue Patterns of Toxa-
Wasserstoffperoxid in Bade- and Trinkwasser	W89-03118 2H	phene in Fish Samples from the Great Lakes and
aus Biochemischer und Pharmakokinetischer		from Rivers of the Southeastern United States,
Sicht), W89-03042 5C	Hyporheic Habitat of River Ecosystems,	W89-02328 5B
1107-03012	W89-03122 2E	Development Management and Application of a
You and Your Drinking Water: Health Implica-	Acidification and Succession in a Flood-Plain	Development, Management, and Analysis of a Long-Term Ecological Research Information
tions for the Use of Cation Exchange Water	Mire in the Norfolk Broadland, U.K.,	Base: Example for Marine Macrobenthos,
Softeners,	W89-03123 2H	W89-02329 10D
W89-03060 5F		100
Problems in Czechoslovakia Regarding Methods	Indirect Effects and Biological Control of Mos-	Natural History of Lakes,
of Removal of Nitrates from Drinking Water,	quitoes by Mosquitofish,	W89-02775 2H
W89-03098 5D	W89-03124 2H	
In Vitro Genotoxicity of Chlorinated Drinking	Comparative Ecology of Marine and Freshwater	Riverine Ecosystems,
Water Processed from Humus-Rich Surface	Phytoplankton,	W89-02986 2H
Water,	W89-03260 2H	Ground Water: A Living Ecosystem,
W89-03202 5C		W89-03084 2F
	Comparative Ecology of Submersed Grass Beds	1107-03004
Asbestos-Contaminated Drinking Water: Its	in Freshwater, Estuarine, and Marine Environ- ments.	Correspondence Between Ecoregions and Spa-
Impact on Household Air, W89-03299 5B	W89-03264 2H	tial Patterns in Stream Ecosystems in Oregon,
W 69-03299 3B	W 65-03204 211	W89-03223 2H
Analysis of Volatile Halogenated Hydrocarbons	Ecological Principles Affecting Community	The 17 to 15 No. 15 The 15 No.
on the ppq Scale,	Structure and Secondary Production by Zoo-	Littoral Zoobenthic Biomass in Lakes, and Its
W89-03301 5A	plankton in Marine and Freshwater Environ-	Relationship to Physical, Chemical, and Trophic Factors,
Sewage Hardness and Mortality from Cancer	ments,	W89-03229 2H
and Cardiovascular Disease,	W89-03267 2H	1107-03227
W89-03309 5D	Comparative Ecology of the Macrofauna of	Phototrophic Picoplankton: An Overview from
	Freshwater and Marine Muds,	Marine and Freshwater Ecosystems,
Results of a Short-Term Toxicity Study for	W89-03268 2H	W89-03259 2H
Three Organic Chemicals Found in Niagara River Drinking Water,	N 115 1 14 6	EDUCATION
W89-03310 5C	Physical Energy Inputs and the Comparative	Fiscal Year 1986 Program Report (Massachu-
	Ecology of Lake and Marine Ecosystems, W89-03272 2A	setts Water Resources Research Center),
DRY WELLS	1107-03272	W89-02587 9D
Dry Wells - Solution or Pollution: An Arizona	Fertility and Disturbance Gradients: A Summa-	110702501
Status Report, W89-02338 5B	ry Model for Riverine Marsh Vegetation,	Fiscal Year 1986 Program Report (Virgin Is-
W 07-02330	W89-03294 2H	lands Water Resources Research Center),
DUPAGE RIVER	ECONOMIC ASPECTS	W89-02588 9D
Intensive Survey of the DuPage River Basin,	Optimizing Operation and Maintenance of	Ground Water and Agriculture, Addressing the
1983.	Water Supply Wells,	Ground Water and Agriculture: Addressing the Information Needs of Pennsylvania's Chesa-
W89-02829 5G	W89-02333 6B	peake Bay Program,
DYE INDUSTRY WASTES		W89-02680 5G
Fate of Water Soluble Azo Dyes in the Activat-	In Situ Aquifer Denitrification: Remediation of	
ed Sludge Process,	Ammonia and Nitrate Contaminated Subsurface	EDWARDS AQUIFER
W89-02935 5D	Environments,	Hydrologic and Geologic Data for the Edwards
DYES	W89-02359 5G	Aquifer Recharge Zone Near Georgetown, Wil
Xanthene Dye Chemiluminescence for Determi-	Value Engineering for Small Communities.	liamson County, Texas, 1986-87,
nation of Free Chlorine in Water.	W89-02865 6B	W89-02499 2F
W89-03183 7B		Relation of Water Chemistry of the Edward
	ECONOMIC EVALUATION Water Percurses of the Univer Colorede Pives	Aquifer to Hydrogeology and Land Use, Sai
EARTHQUAKE ENGINEERING Dynamic Reservoir Interaction with Monticello	Water Resources of the Upper Colorado River Basin: Problems and Policy Alternatives,	Antonio Region, Texas,
Dynamic Reservoir Interaction with Monticello Dam,	W89-02635 6D	W89-02514 5H
W89-02848 8A		
	Economic Evaluation of Air Stripping to	EFFLUENTS
Residual Strength of Sand From Dam Failures	Remove Volatile Organic Compounds from	Ocean Outfall System for Dense and Buoyan
in the Chilean Earthquake of March 3, 1985, W89-02851	Water, W89-02976 SF	Effluents, W89-03108

Syntrophic Bacteria Process to Convert a Pulp Mill's Spent Sulphite Liquor to Hydrogen Sul- phide,	Limestone Weathering Under a Soil Cover and the Evolution of Limestone Pavements, Malham District, North Yorkshire, UK,	Health and Environmental Effects Profile for Phenylenediamines. W89-02868
W89-03115 5D	W89-02740 2J	
Influence of Na and Ca Alkalinity on UASB Treatment of Olive Mill Effluents: I. Preliminary	Valley Excavation in the Yorkshire Dales Karst, W89-02742 2F	Preliminary Environmental Assessment of the Contamination Associated with Lake Calumet, Cook County, Illinois,
Results, W89-03116 5D	Development Control Procedures in England	W89-02870 5B
	and Wales, W89-02748 6F	New Haven Harbor Numerical Model Study,
Groundwater Assessment Modeling Under the		W89-02874 6G
Resource Conservation and Recovery Act, W89-02995 5B	Hydrochemical Characteristics of a Dartmoor Hillslope, W89-02903 2E	Causes of Wetland Loss in the Coastal Central Gulf of Mexico. Volume 3. Appendices. W89-02879
ELECTRIC POWER PRODUCTION	Magnitude and Frequency Characteristics of	
Nearshore Transport Processes Affecting the Dilution and Fate of Energy-Related Contami-	Suspended Sediment Transport in Devon Rivers,	U.S. Production of Manufactured Gases: Assessment of Past Disposal Practices, W89-02964 SE
nants, W89-02972 5B	W89-02904 2J	
	Relationship Between Soil Creep Rate and Cer-	Cumulative Impact Assessment: Issues to Con- sider in Selecting a Cumulative Assessment
ELECTRICAL RESISTANCE BLOCKS Applying Electrical Resistance Blocks for Unsaturated Zone Monitoring at Arid Sites,	tain Controlling Variables in a Catchment in Upper Weardale, Northern England, W89-02905 2J	Method, W89-02965 50
W89-02352 7B		Uses of, and Human Impact on Rivers,
ELECTROLYSIS	Appendicitis Epidemic Following Introduction of Piped Water to Anglesey,	W89-02988 40
Electrolytic Recovery Theory, Application, Ad-	W89-03041 5F	ENVIRONMENTAL IMPACT
vantages, W89-02407 5D	Coastal Lagoons of East Anglia, U.K., W89-03184 2L	Monitoring and Quality Assurance Procedures for the Study of Remote Watershed Ecosystems
ELECTROPLATING	ENRICHMENT	W89-02330 5A
Plating Waste Sludge Metal Recovery,	Influence of Nutrient Enrichment and Light	Consequences of Dredging,
W89-02395 5D	Availability on the Abundance of Aquatic Ma-	W89-02700 2L
Howard Plating Clean Up Their Act with Mag-	crophytes in Florida Streams, W89-03231 5C	Effects of Gas-Pipeline Construction on the
nesium Hydroxide, W89-02401 5D	ENRICHMENT *MARINE ENVIRONMENT	Aquatic Ecosystem of Canada Creek, Presque Isle County, Michigan,
EMULSIONS	Nutrient Limitation of Phytoplankton in Fresh-	W89-02861 40
Separators and Emulsion Separation Systems for	water and Marine Environments: A Review of Recent Evidence on the Effects of Enrichment,	Effects of Hydroelectric Scheme on Fluvia
Petroleum, Oil, and Lubricants, W89-02808 5D	W89-03261 2H	Ecosystems within the Spanish Pyrenees,
	ENTERIC BACTERIA	W89-03138 60
Fate of Crude Oil at Sea and the Natural Dispersion of Crude Oils and Water-in-Oil Emulsions:	Appendicitis Epidemic Following Introduction of Piped Water to Anglesey,	Fish Populations of a Small Lowland Channel ized River in England Subject to Long-Term
Results of Experiments Using a Laboratory Test Tank and Free-Floating Rings at Sea,	W89-03041 5F	River Maintenance and Management Works, W89-03139 60
W89-02944 5B	ENVIRONMENTAL AUDIT	W 65-03139 GC
ENCAPSULATION	Innovative Designs for Water Quality Monitor-	Role of Riparian Woods in Regulating Nitroger
Combined Fixed Biological Film Media and	ing: Are We Asking the Questions Before the Data Are Collected,	Fluxes Between the Alluvial Aquifer and Sur face Water: A Conceptual Model,
Evaporative Cooling Media to Solidify Hazard- ous Wastes for Encapsulation and Efficient Dis-	W89-02320 7A	W89-03140 6C
posal,	ENVIRONMENTAL EFFECTS	Radial Stem Growth of Coniferous Trees nea
W89-02294 5D	Evaluation of Rain Chemistry Data for the John F. Kennedy Space Center, Florida and the Uni-	Swedish Reservoirs, W89-03142 60
ENERGY DISSIPATION	versity of Central Florida, Orlando, Florida,	
Energy Dissipation Rate Approach in River Me- chanics,	W89-02708 4C	Effect of Impoundment on the Growth of Bagrus docmac in Lake Nasser,
W89-02453 2J	Clam Shell Dredging in Lakes Pontchartrain	W89-03143 60
ENERGY SOURCES	and Maurepas, Louisiana, W89-02715 6G	Response of Coastal Plants to Increase in Sub
Physical Energy Inputs and the Comparative		mergence and Salinity,
Ecology of Lake and Marine Ecosystems, W89-03272 2A	Dredging: Technology and Environmental Aspects. Citations from the Life-Sciences Collection Database (Jan 78 - Aug 87).	W89-03188 21 ENVIRONMENTAL IMPACT STATEMENT
ENERGY STORAGE	W89-02783 2J	Clam Shell Dredging in Lakes Pontchartrain
Aquifer Thermal Energy Storage in Finland, W89-03082 4B	Effects on Suspended and Substrate Sediments in Two Streams Resulting from Different Gas-	and Maurepas, Louisiana, W89-02715 60
ENGINEERING	Pipeline Installation Techniques,	Completion Impact Assessment Application of
Value Engineering for Small Communities.	W89-02823 4C	Cumulative Impact Assessment: Application of Methodology,
W89-02865 6B	Cumulative Impact Assessment: Application of a	W89-02824 76
ENGLAND	Methodology,	Souris River Basin Project, Saskatchewar
Chemical Weathering of the East Yorkshire Chalk,	W89-02824 7C	Canada - North Dakota, U.S.A. General Pla Report and Draft Environmental Impact State
W89-02731 2K	Effects of Gas-Pipeline Construction on the Aquatic Ecosystem of Canada Creek, Presque	ment.
Stable Isotopes: An Investigation into Their Ap-	Isle County, Michigan,	W89-02937 8A
plication in Karst Hydrology in the U.K., with	W89-02861 4C	ENVIRONMENTAL MANAGEMENT
Special Reference to the Malham Area, North	Health and Environmental Effects Profile for	Environmental Management of the Zamber
Yorkshire, W89-02734 2F	1,2,3,4,5-Penta-Bromo-6-Chlorocyclohexane. W89-02866 5C	River System, W89-03144 56

5G

ENVIRONMENTAL POLICY

ENVIRONMENTAL POLICY New Approaches to Monitoring Aquatic Eco-	Sources of Sediment and Channel Changes in Small Catchments of Romania's Hilly Regions, W89-02896 2J	Hydrodynamics of Estuaries, Volume II: Estuarine Case Studies. W89-02692 2L
systems. W89-02317 5A	Landsliding, Slope Development and Sediment	Oceanography of Chesapeake Bay,
Coastal Monitoring: Evaluation of Monitoring Methods in Narragansett Bay, Long Island	Yield in a Temperate Environment: Northeast Romania,	W89-02693 2L
Sound and New York Bight, and a General Monitoring Strategy.	W89-02897 2J	Puget Sound: A Fjord System Homogenized with Water Recycled over Sills by Tidal Mixing.
W89-02325 5A	Development of Field Techniques for Assess- ment of River Erosion and Deposition in Mid-	W89-02694 2L
Environmental Auditing: Management's Key to Effective Environmental Compliance,	Wales, UK, W89-02898 2J	Laguna Madre of Texas: Hydrography of a Hypersaline Lagoon,
W89-02409 6A	EROSION CONTROL	W89-02695 2L
ENVIRONMENTAL PROTECTION Liability for Managing Hazardous Wastes: Past,	Canal Design by an Armouring Process, W89-02441 8A	Mobile Bay Estuary: Stratification, Oxygen De- pletion, and Jubilees,
Present and Future, W89-02398 6E	River Bed Scour and Construction of Stone	W89-02696 2L
W89-02398 6E Environmental Auditing: Management's Key to	Riprap Protection, W89-02442 8A	Circulation Anomalies in Tropical Australian Estuaries,
Effective Environmental Compliance,	Mountain Torrent Erosion,	W89-02697 2L
W89-02409 6A	W89-02447	Physical Oceanography of the St. Lawrence Es-
Application of Environmental Risk Analysis to	Final Report: Lake Erie Conservation Tillage	tuary,
Groundwater Protection, W89-03083 5G	Demonstration Projects. W89-02835 3F	W89-02698 2L
ENVIRONMENTAL QUALITY	Definite Project Report for Section 14. Emer-	Oceanographic Characteristics of the Seine Es-
Monitoring, Research, and Management: Inte-	gency Streambank Protection, Sangamon River	W89-02699 2L
gration for Decisionmaking in Coastal Marine	Sewage Treatment Facility, Riverton, Illinois W89-02934 4D	
Environments, W89-02323 5A		Consequences of Dredging, W89-02700 2L
	ESTIMATING Estimate of Precipitation Enhancement Potentia	
ENVIRONMENTAL STUDIES Model Calibration Based on Random Environ-	for the Duero Basin of Spain,	Djinnang II: A Facility to Study Mixing in Stratified Waters,
mental Fluctuations,	W89-03306 3E	W89-02701 7B
W89-03105 7A	ESTIMATING EQUATIONS	Biological Surveys of Estuaries and Coasts.
EPHEMERAL STREAMS	Technique for Estimating Flood-Peak Discharge and Frequencies on Rural Streams in Illinois	W90 02750 7D
Field Study of Ephemeral Stream-Aquifer Inter- action,	W89-02512 2E	
W89-02349 2F	ESTIMATION	W89-02760 7B
Ephemeral Runoff and Groundwater Recharge, W89-02350 2F	Development of Estimation Methods for Tribu tary Loading Rates of Toxic Chemicals, W89-02547 55	Birds,
EPILIMNION		Formulas for Velocity, Sediment Concentration
Photosynthetic Carbon Metabolism by Phyto- plankton in a Nitrogen-Limited Reservoir, W89-03215 2H	ESTUARIES Multidecade Trend-Monitoring Program fo Chesapeake Bay, A Temperate East Coast Estu	and Suspended Sediment Flux for Steady Uni- Directional Pressure-Driven Flow,
	ary, W89-02324 7A	W89-02779 2J
EFILITHIC BACTERIA Effects of Heavy Metal Pollution on Epilithic		New Haven Harbor Numerical Model Study,
Bacteria, W89-02552 5C	Flow Simulation Model of the Tidal Potoma River,	
EROSION	W89-02529 21	tion and Circulation Investigation,
Erosion and Sedimentation,	Hydrodynamics of Estuaries, Volume I: Estuarine Physics.	- W89-02875 4C
W89-02723 2J	W89-02682 21	
Valley Excavation in the Yorkshire Dales Karst, W89-02742 2F	Dynamics of Partially Mixed Estuaries, W89-02683 21	duction in Scirpus Tidal Marshes of the St. Lawrence Estuary, Quebec, W89-03055 2L
Runoff and Sediment Production in a Small Peat-Covered Catchment: Some Preliminary Re-	Dynamic Control by Topography in Estuaries W89-02684	Change in Sedimentation Following River Di-
sults, W89-02888 2E	Dispersion in Shallow Estuaries,	Canada,
Hydrology and Solute Uptake in Hillslope Soils	W89-02685	
on Magnesian Limestone: the Whitwell Wood Project,	Tidally Generated Estuarine Mixing Processes W89-02686	River Estuary,
W89-02891 2G	Tidal Dynamics of Estuaries,	W89-03194 2L
Surface and Subsurface Sources of Suspended	W89-02687	Trement Phone Controlled in Control
Solids in Forested Drainage Basins in the Keuper Region of Luxembourg,	Estuarine Residence Times,	Sediments, W89-03196 5B
W89-02892 2J	W89-02688	Kinetic Control of Dissolved Phosphate in Natu-
Sources of Variation of Soil Erodibility in	Estuarine Fronts, W89-02689 2	ral Rivers and Estuaries: A Primer on the Phos-
Wooded Drainage Basins in Luxembourg, W89-02893 2J	Modeling of Tidally Induced Residual Current	phate Butter Mechanism,
Microerosion Processes and Sediment Mobiliza-	W89-02690 2	Denitrification in Freshwater and Coastal
tion in a Roadbank Gully Catchment in Central	Eulerian and Lagrangian Modeling of Estuarin	e Marine Ecosystems: Ecological and Geochemi-
Oklahoma, W89-02894 2J	Hydrodynamics, W89-02691 2	cal Significance, L W89-03256 2H

Freshwater and Marine Coupling in Estuaries o		FATE OF POLLUTANT
the Mississippi River Deltaic Plain, W89-03271 2E	Phytoplankton and Bacteria, W89-03244 2H	Role of Riparian Woods in Regulating Nitrogen Fluxes Between the Alluvial Aquifer and Sur-
Trace Metal Transport in a Tropical Estuary W89-03276 2I	Multidecade Trend-Monitoring Program for	face Water: A Conceptual Model, W89-03140 6G
	Chesapeake Bay, A Temperate East Coast Estu-	FATE OF POLLUTANTS
Iodine Speciation in Chesapeake Bay Waters W89-03277		Quantitative Studies of Biodegradation of Petro- leum And Some Model Hydrocarbons in
Estuaries: Concern Over Troubled Waters, W89-03279 7/	Influence of Nutrient Enrichment and Light Availability on the Abundance of Aquatic Ma-	Ground Water and Sediment Environments, W89-02674 5B
	crophytes in Florida Streams,	Processes, Coefficients, and Models for Simulat-
ESTUARINE ENVIRONMENT	W89-03231 5C	ing Toxic Organics and Heavy Metals in Surface
Mobile Bay Estuary: Stratification, Oxygen De pletion, and Jubilees,	Nuisance Phytoplankton Blooms in Coastal, Es-	Waters,
W89-02696 21		W89-02788 5B
Biological Surveys of Estuaries and Coasts. W89-02759	B EVAPORATION	Acid Precipitation Literature Review 1986: Emission, Transport, Transformation and Depo- sition of Acidic Trace Species,
m ' n' l ' 10	Combined Fixed Biological Film Media and	W89-02822 5B
Planning Biological Surveys, W89-02760 7	Evaporative Cooling Media to Solidify Hazard- ous Wastes for Encapsulation and Efficient Dis-	
1107-021-00	posal,	Nearshore Transport Processes Affecting the
Remote Sensing,	W89-02294 5D	Dilution and Fate of Energy-Related Contami- nants,
W89-02761 7.	Determination of Evaporation and Seepage	W89-02843 5B
Birds,	Losses, Upper Lake Mary near Flagstaff, Arizo-	
W89-02772 2	L na,	Maryland Synoptic Stream Chemistry Survey:
The state of Wilder and the state of the sta	W89-02558 2H	Estimating the Number and Distribution of
Temporal Relationship of Vibrio parahaemolyt	Influence of Potential Evaporation on the Varia-	Streams Affected By or At Risk from Acidifica- tion,
cus in Patients and the Environment, W89-03064 5		W89-02846 5B
Nitrogen Fixation in Freshwater, Estuarine, an	d	National Acid Precipitation Assessment Pro-
Marine Ecosystems: 1. Rates and Importanc W89-03254	H Pollution Control Using Room Temperature	gram: Annual Report, 1986. W89-02873 5B
Nitrogen Fixation in Freshwater, Estuarine, ar Marine Ecosystems: 2. Biogeochemical Con		Fate of Crude Oil at Sea and the Natural Disper- sion of Crude Oils and Water-in-Oil Emulsions
trols,	EVAPOTRANSPIRATION	Results of Experiments Using a Laboratory Test
	H Evapotranspiration of Phreatophytes in the San Luis Valley, Colorado,	Tank and Free-Floating Rings at Sea, W89-02944 SB
Comparative Ecology of Submersed Grass Ber		
in Freshwater, Estuarine, and Marine Environments,	Evapotranspiration of Native Vegetation in the	Nearshore Transport Processes Affecting the Dilution and Fate of Energy-Related Contami-
W89-03264 2	W89-02481 2D	nants, W89-02972 5F
Production and Use of Detritus in Vario		W 07-027/2
Freshwater, Estuarine, and Coastal Marine Ec	Powder River Basin, Wyoming and Montana,	Groundwater Assessment Modeling Under the
systems, W89-03266 2	H W89-02524 2D	Resource Conservation and Recovery Act,
W 89-03286		W89-02995 5E
ESTUARINE FRONTS	EXPLOSIVES Process Development and Treatment Plant	Biological Degradation of Volatile Chlorinated
Estuarine Fronts,	Startun for an Explosives Industry Wastewater	Hydrocarbons in Groundwater,
W89-02689	W89-02287 5D	W89-03081 5E
EULERIAN EQUATION	EVERACTION METHOD	Effect of Unsaturated/Saturated Zone Property
Lagrangian-Eulerian Approach to Modelii Hydrogeochemical Transport of Multi-Comp	Groundwater Protection by Accelerated Testing	Upon the Hydrogeochemical and Microbiologi
nent Systems,	or organic circinical breaktinoughs or son bar-	Attenuation of Landfill Leachate Components
	riers, W89-02585 5A	77100 0200#
EULERIAN MODELING	EXTRACTION SYSTEMS	Biodegradation Modeling at Aviation Fuel Spil
Eulerian and Lagrangian Modeling of Estuari Hydrodynamics,	note of requirer resting in Design of Constant	Site, W89-03100 5C
	Head Extraction Systems, W89-02346 7B	
	W 89-02340 /B	Temperature Dependence of Liquid Film Coel
EUPHOTIC ZONE	FARM WASTES	ficient for Gas Transfer,
Phosphorous Flux from Lake Sediments: Effe	tione of Themone und Training Compounds in	W89-03112 21
of Epipelic Algal Oxygen Production, W89-03248	Anaerobic Digestion Processes, 2H W89-02924 5D	Biodegradation of Nitrogen- and Oxygen-Con
DUDASIA		taining Aromatic Compounds in Groundwate
EURASIA Snow Cover Record in Eurasia,	FARMING Principles of Form Irrigation System Design	from an Oil-Contaminated Aquifer, W89-03149 51
	Principles of Farm Irrigation System Design, 2C W89-02422 3F	
Eurasian Snow Cover and Seasonal Forecast	,	Biological Transformation and Detoxification of 7,12-Dimethylbenz(a)anthracene in Soil Systems
Indian Summer Monsoon Rainfall,	Treatment of Farnham and Ashley Reservoir	W89-03161 5
W89-03054	2B Water by Krofta Sandfloat Process System	Photodecomposition of Chlorophenols in Aque
EUTROPHIC LAKES	Project Documentation, W89-02950 5F	
Combining Field Measurements for Speciat	on 3F	W89-03200 5
in Non Perturbable Water Samples: Applicat	on Treatment of Farnham and Ashley Reservoir	
to the Iron and Sulfide Cycles in a Eutrop		
Lake, W89-02645	Final Project Report, 5B W89-02951 5F	Freshwater Systems, W89-03201 5
11 07-04043	JD 1107-02731 JI	110703201

FATE OF POLLUTION

FATE OF POLLUTION	low Ground Waters Near Woodward, Oklaho-	with Floating Filters: I. Test Arrangements and
Sensitivity Analysis of Adsorption and Degrada- tion Parameters in the Modeling of Pesticide	ma,	General Results,
Transport in Soils,	W89-02671 5B	W89-03094 5F
W89-03150 2G	National Assessment of Council Water Countries	
FATHEAD MINNOWS	National Assessment of Ground Water Contamination from Pesticides and Fertilizers,	Biological Treatment of Groundwater in Basins with Floating Filters: II. The Role of Microor-
Acute Toxicity and Behavioral Effects of Acry- lates and Methacrylates to Juvenile Fathead	W89-02673 5B	ganisms in Floating Filters, W89-03095 5G
Minnows,	Nitrogen and Ground Water Protection. W89-02679 5G	Belt Filter Press Dewatering of Wastewater
W89-03313 5C	1107-02017	Sludge.
FAUNA	Ground Water and Agriculture: Addressing the	W89-03099 5D
Meiofauna,	Information Needs of Pennsylvania's Chesa- peake Bay Program,	T
W89-02766 2L	W89-02680 5G	Treatment of Potable Water from Seoul, Korea by Flotation, Filtration and Adsorption,
Comparative Ecology of the Macrofauna of	Investigations on Leaching of Dicyandiamide	W89-03319 5F
Freshwater and Marine Muds, W89-03268 2H	and its Decomposition in Flooded Soils (Unter-	FINLAND
W 07-03200	suchungen zur Auswaschung von Dicyandiamid	Chemical-Biological Treatment versus Chemical
FEEDS	und Dessen Abbau in Uberstauten Boden), W89-03043 5B	Treatment: A Case Study,
Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Perform-	W89-03043 5B	W89-02814 5D
ance of their Offspring,	FIELD TESTS	Atmospheric, Geological, Marine, and Anthro-
W89-03061 5E	Recognizing Petroleum Hydrocarbon Contami-	pogenic Effects on Groundwater Quality in Fin-
FENS	nation in the Vadose Zone with Photoionization Detection Scanning of Field Samples,	land,
Acidification and Succession in a Flood-Plain	W89-02351 5A	W89-03076 5B
Mire in the Norfolk Broadland, U.K.,		Aquifer Thermal Energy Storage in Finland,
W89-03123 2H	Combining Field Measurements for Speciation in Non Perturbable Water Samples: Application	W89-03082 4B
FERTILITY	to the Iron and Sulfide Cycles in a Eutrophic	
Growth, Fecundity, and Energy Stores of White	Lake,	FISH Ges Character and Paridus Patterns of Tone
Sucker (Catostomus commersoni) from Lakes	W89-02645 5B	Gas Chromatographic Residue Patterns of Toxa- phene in Fish Samples from the Great Lakes and
Containing Elevated Levels of Copper and Zinc,	Interpretation of 'Controlled' vs 'Natural' Ex-	from Rivers of the Southeastern United States,
W89-03225 5C	periments in Streams,	W89-02328 5B
Effect of Long-Term Exposure to Acid, Alumi-	W89-03117 7A	Poleting Abundance and Distribution of Vounc
num, and Low Calcium on Adult Brook Trout	Simulations of Physical Nonequilibrium Solute	Relative Abundance and Distribution of Young- of-the-Year Fishes and Minnows in Lake
(Salvelinus fontinalis): I. Survival, Growth, Fe- cundity, and Progeny Survival,	Transport Models: Application to a Large-Scale	Sharpe, South Dakota,
W89-03241 5C	Field Experiment,	W89-02426 2H
PERMIT IN A PLONE	W89-03148 2F	Fish (Survey of).
FERTILIZATION Emergence of Chironomidae (Diptera) in Fertil-	Portable Environment Test System: A Field As-	W89-02771 7B
ized and Natural Lakes at Saqvaqjuac, N.W.T.,	sessment of Organotin Leachates. Test and Eval-	
W89-03216 2H	uation, W89-03324 5C	Distribution Pattern and Reduction of Polychlo- rinated Biphenyls (PCB) in Bluefish Pomatomus
FERTILIZER	W 65-03324 SC	saltatrix (Linnaeus) Fillets through Adipose
Soil Testing As a Guide to Prudent Use of	FIJI	Tissue Removal,
Nitrogen Fertilizers in Oklahoma Agriculture,	Hydrogeological Mapping in Fiji, W89-02366 2F	W89-03199 5B
W89-02664 7B	W89-02366 2F	Sensitivity of Branchial Mucus to Crude Oil
FERTILIZERS	FILTER-BACKWASHING WATER	Toxicity in a Freshwater Fish, Colisa fasciatus,
In Situ Aquifer Denitrification: Remediation of	Polyelectrolytes for the Treatment of Tap and	W89-03204 5C
Ammonia and Nitrate Contaminated Subsurface Environments,	Filter Back Washing Water, W89-02797 5F	Chlorine Sensitivity of Early Life Stages of
W89-02359 5G		Freshwater Fish,
	FILTERS	W89-03333 5C
Efficient Nitrogen Fertilization in Agricultural Production Systems,	Belt Filter Press Dewatering of Wastewater Sludge.	FISH BEHAVIOR
W89-02665 5B	W89-03099 5D	Indirect Effects and Biological Control of Mos-
	Believels for the Dollar of Maritanian Wall	quitoes by Mosquitofish,
Nitrates and Pesticides in Ground Water: An Analysis of a Computer-Based Literature	Rationale for the Design of Monitoring Well Screens and Filter Packs,	W89-03124 2H
Search,	W89-03332 5B	Acute Toxicity and Behavioral Effects of Acry-
W89-02666 5B	THE COLUMN ASSESSMENT OF THE COLUMN ASSESSMENT	lates and Methacrylates to Juvenile Fathead
Behavior And Subsurface Transport of Agro-	FILTRATION Experiences with Granular Activated Carbon	Minnows,
chemicals in Conservation Systems,	Filtration and On-Site Reactivation at Jefferson	W89-03313 5C
W89-02667 5B	Parish, Louisiana,	FISH CONTROL AGENTS
Impacts of Agricultural Chemicals on Ground	W89-02790 5F	Photodegradation of the Lampricide 3-Trifluor-
Water Quality in Iowa,	Humic Substances Removal by Alum Coagula-	omethyl-4-nitrophenol (TFM): 2. Field Confir-
W89-02668 5B	tion: Direct Filtration at Low pH,	mation of Direct Photolysis and Persistence of Formulation Impurities in a Stream During
Assessing Some Potentials for Changing Agro-	W89-02795 5F	Treatment,
nomic Practices and Improving Ground Water	Modeling the Effects of Adsorbed Hydrolyzed	W89-03175 5B
Quality: Implications from a 1984 Iowa Survey,	Al(III)-Ions on Deep Bed Filtration,	FIGH DIFTS
W89-02669 5G	W89-02796 5F	FISH DIETS Effect of Submersed Aquatic Macrophytes on
Assessment of Empirical Methodologies for Pre-	Treatment of Rome Raw Water by Krofta Sand-	Resource Partitioning in Yearling Rock Bass
dicting Ground Water Pollution from Agricul-	float Process System Project Documentation	(Ambloplites rupestris) and Pumpkinseeds (Le-
tural Chemicals, W89-02670 5B	(Part C), W89-02943 5F	pomis gibbosus) in Lake St. Clair, W89-03171 2H
	W89-02943 5F	W89-03171 2H

Modeling the Response of Lake-Aquifer Sys- Mathematical Hydraulic Model of the River

FISH MANAGEMENT

ing Habitat,	W89-02341 5C	River,
W89-03172 5C		W89-03141 4A
EIGH BUYGIOLOGY	Case Study of Minimum Streamflow for Fishery	
FISH PHYSIOLOGY Long-Term Sublethal Acid Exposure in Rain-	Habitat in the Yampa River, W89-02460 2J	FLOOD DAMAGE Flood Problem in Perspective,
bow Trout (Salmo gairdneri) in Soft Water:	W89-02460 2J	W89-02744 4A
Effects on Ion Exchanges and Blood Chemistry,	Accounting for Effort When Comparing Tropi-	1107-02/17
W89-03226 5C	cal Fisheries in Lakes, River-Floodplains, and	Flood Loss Reduction by Metropolitan Regional
Physiological Disturbances in Fish Living in	Lagoons,	Authorities in the United States,
Coastal Water Polluted with Bleached Kraft	W89-03269 2H	W89-02752 6E
Pulp Mill Effluents,	Applicability of Fish Yield Indices in Freshwa-	Assessing the Health Effects of Floods,
W89-03234 5C	ter and Marine Ecosystems,	W89-02757 2E
Effect of Long-Term Exposure to Acid, Alumi-	W89-03270 2H	FLOOD FORECASTING
num, and Low Calcium on Adult Brook Trout	FJORDS	Flood Warning Dissemination: The British Ex-
(Salvelinus fontinalis): II. Vitellogenesis and Os-	Puget Sound: A Fjord System Homogenized	perience,
moregulation,	with Water Recycled over Sills by Tidal Mixing,	W89-02753 6F
W89-03242 5C	W89-02694 2L	Warning Dissemination and Response with
Morphometric Changes in Gill Secondary La-	FLAGELLATES	Short Lead Times,
mellae of Brook Trout (Salvelinus fontinalis)	Microflagellate-Picoplankton Food Linkage in	W89-02754 6F
after Long-Term Exposure to Acid and Alumi-	the Water Column of Lake Biwa,	FLOOD FREQUENCY
num, W89-03243 5C	W89-03245 2H	Statistical Analyses of Flood Frequency, Low-
	FLASH FLOODS	Flow Frequency and Flow Duration of Streams
FISH POPULATIONS	Stream Response to Flash Floods in Upland	in the Philadelphia Area, Pennsylvania,
Fish Populations of a Small Lowland Channel- ized River in England Subject to Long-Term	Scotland,	W89-02492 2E
River Maintenance and Management Works,	W89-02912 2E	Method for Delineating Flood-Prone Areas in
W89-03139 6G	TOATATION	the Great Basin of Nevada and Adjacent States,
Effect of Impoundment on the Growth of	FLOATATION Treatment of Farnham and Ashley Reservoir	W89-02500 2E
Bagrus docmac in Lake Nasser,	Water by Krofta Sandfloat Process System -	Technique for Estimating Flood-Peak Discharge
W89-03143 6G	Project Documentation,	and Frequencies on Rural Streams in Illinois,
Madification and Assessment of an Index of	W89-02950 5F	W89-02512 2E
Modification and Assessment of an Index of Biotic Integrity to Quantify Stream Quality in	FLOCCUATION	Water Resources Investigations in Tennessee:
Southern Ontario.	Treatment of Farnham and Ashley Reservoir	Programs and Activities of the U.S. Geological
W89-03211 4C	Water by Krofta Sandfloat Process System	Survey, 1987-1988,
Effect of pH on Speciation and Toxicity of	Project Documentation,	W89-02559 7C
Aluminum to Rainbow Trout (Salmo gairdneri),	W89-02950 5F	Estimating Magnitude and Frequency of Floods
W89-03213 5C	FLOCCULATION	for Wisconsin Urban Streams,
Accumulation of Cadmium by Rainbow Trout,	Treatment of Filter Effluents from Dewatering	W89-03003 2E
Salmo Gairdneri, During Extended Exposure,	of Sludges by a New High Performance Floccu-	FLOOD HAZARDS
W89-03220 5B	lation Reactor, W89-02819 5D	Method for Delineating Flood-Prone Areas in
Growth, Fecundity, and Energy Stores of White	W 69-02619	the Great Basin of Nevada and Adjacent States,
Sucker (Catostomus commersoni) from Lakes	Evaluation of Sludge Settleability be Floc Char-	W89-02500 2E
Containing Elevated Levels of Copper and Zinc,	acteristics,	FLOOD HYDROGRAPHS
W89-03225 5C	W89-03167 5D	Simulation of Flood Hydrographs for Georgia
Physiological Evidence of Acclimation to Acid/	FLOOD CONTROL	Streams, W89-03002 5E
Aluminum Stress in Adult Brook Trout (Salve-	Flood Hazard Management: British and Interna-	W89-03002 5E
linus fontinalis): I. Blood Composition and Net	tional Perspectives.	FLOOD INSURANCE
Sodium Fluxes,	W89-02743 4A	Flood Hazard Management: British and Interna-
W89-03237 5C	Flood Problem in Perspective,	tional Perspectives. W89-02743 4A
Physiological Evidence of Acclimation to Acid/	W89-02744 4A	W 07-02143
Aluminum Stress in Adult Brook Trout (Salve-	Institutional and Policy Context,	Flood Insurance and Floodplain Management,
linus fontinalis): II. Blood Parameters by Cannu- lation,	W89-02745 6F	W89-02750 6F
W89-03238 5C		FLOOD MAPPING METHODS
	Urban Flood Problems: Their Scale and the	Method for Delineating Flood-Prone Areas in
Sodium Transport in the Brook Trout, Salve- linus fontinalis: Effects of Prolonged Low pH	Policy Response, W89-02746 4A	the Great Basin of Nevada and Adjacent States,
Exposure in the Presence and Absence of Alu-		W89-02500 2E
minum,	Design Standards for Building in Flood Hazard	
W89-03239 5C	Areas: A Critical Look at US Experience and	Technique for Estimating Flood-Peak Discharge
Effects of Low pH and Aluminum on Ventila-	Possible Applications Abroad, W89-02751 4A	and Frequencies on Rural Streams in Illinois, W89-02512 2E
tion in the Brook Trout (Salvelinus fontinalis),		
W89-03240 5C	Flood Loss Reduction by Metropolitan Regional Authorities in the United States,	Peak/Risk/Culvert: A Program to Compute
Effect of Long-Term Exposure to Acid, Alumi-	W89-02752 6E	Peak Flows, Hydrologic Risk, and Circular Cul- vert Sizes at Forest Road Crossings,
num, and Low Calcium on Adult Brook Trout		W89-02831 2E
(Salvelinus fontinalis): I. Survival, Growth, Fe-		
cundity, and Progeny Survival, W89-03241 5C	W89-02756 6B	Simulation of Flood Hydrographs for Georgia Streams.
	Souris River Basin Project, Saskatchewan,	W89-03002 5E
FISHERIES Monitoring the Nation's Waters A New Per	Canada - North Dakota, U.S.A. General Plan Report and Draft Environmental Impact State-	
Monitoring the Nation's WatersA New Per- spective.	ment.	for Wisconsin Urban Streams,
W89-02318 5A		

FLOOD PEAK

Estimating Generalized Skew of the Log-Pear- son Type III Distribution for Annual Peak	Design Standards for Building in Flood Hazard Areas: A Critical Look at US Experience and	FLORIDA Summary of Well Construction, Testing, and
Floods in Illinois,	Possible Applications Abroad,	Preliminary Findings from the Alligator Alley
W89-03006 2E	W89-02751 4A	Test Well, Broward County, Florida, W89-02465 4B
FLOOD PEAKS	Floodplain Mapping and Beyond: A State Per-	
Hydrologic Data for Computation of Sediment	spective,	Potentiometric Surface of the Upper Floridan
Discharge, Toutle and North Fork Toutle	W89-02755 6F	Aquifer in the St. Johns River Water Manage- ment District and Vicinity, Florida, September
Rivers near Mount St. Helens, Washington, 1980-84.	FLOOD PLAINS	1987,
W89-02571 7C	Roughness Coefficients for Densely Vegetated	W89-02503 7C
PLOOD BLAIN MANACEMENT	Flood Plains,	Bibliography of U.S. Geological Survey Reports
FLOOD PLAIN MANAGEMENT Flood Hazard Management: British and Interna-	W89-02502 2E	on the Water Resources of Florida, 1886-1984,
tional Perspectives.	Floodplain Response of a Small Tropical	W89-02527 10C
W89-02743 4A	Stream,	
Flood Problem in Perspective,	W89-02885 2E	Potentiometric Surface of the Intermediate Aq- uifer System, West-Central Florida, September
W89-02744 4A	Biogenic Gases and the Oxidation and Reduc-	1986,
	tion of Carbon in Amazon River and Floodplain	W89-02532 7C
Institutional and Policy Context, W89-02745 6F	Waters,	Summer of the Hudesland of the Floridan Ac
W89-02745 6F	W89-03247 2E	Summary of the Hydrology of the Floridan Aq- uifer System in Florida and in Parts of Georgia,
Urban Flood Problems: Their Scale and the	PLOOD BROTH PC	South Carolina, and Alabama,
Policy Response,	FLOOD PROFILES Method for Delineating Flood-Prone Areas in	W89-03034 2F
W89-02746 4A	the Great Basin of Nevada and Adjacent States,	Information Parishment and Links
Power Behind the Flood Scene,	W89-02500 2E	Influence of Nutrient Enrichment and Light Availability on the Abundance of Aquatic Ma-
W89-02747 6E		crophytes in Florida Streams,
Development Control Broadures in England	FLOOD PROTECTION	W89-03231 5C
Development Control Procedures in England and Wales,	Flood Hazard Management: British and Interna-	
W89-02748 6F	tional Perspectives. W89-02743 4A	FLORIDAN AQUIFER
	W 89-02/43	Summary of Well Construction, Testing, and Preliminary Findings from the Alligator Alley
Conflicting Objectives in Floodplain Manage- ment: Flood Damage Reduction Versus Herit-	Flood Loss Reduction by Metropolitan Regional	Test Well, Broward County, Florida,
age Preservation,	Authorities in the United States,	W89-02465 4B
W89-02749 6F	W89-02752 6E	n
	Souris River Basin Project, Saskatchewan,	Potentiometric Surface of the Upper Floridan Aquifer in the St. Johns River Water Manage-
Flood Insurance and Floodplain Management, W89-02750 6F	Canada - North Dakota, U.S.A. General Plan	ment District and Vicinity, Florida, September
W89-02750 6F	Report and Draft Environmental Impact State-	1987,
Design Standards for Building in Flood Hazard	ment.	W89-02503 7C
Areas: A Critical Look at US Experience and	W89-02937 8A	FLOTATION
Possible Applications Abroad, W89-02751 4A	Watertown, Minnesota: Flood Proofing Infor-	Separation of Heavy Metals from Effluents by
W69-02/31 4A	mation.	Flotation,
Flood Loss Reduction by Metropolitan Regional	W89-02939 6F	W89-02803 5D
Authorities in the United States, W89-02752 6E	FLOOD ROUTING	Treatment of Farnham and Ashley Reservoir
W89-02752 6E	Flood Inundation Modelling Using MILHY,	Water by Krofta Sandfloat Process System -
Flood Warning Dissemination: The British Ex-	W89-03330 2E	Final Project Report,
perience,		W89-02951 5F
W89-02753 6F	FLOOD STAGES	Flotation Processes,
Floodplain Mapping and Beyond: A State Per-	Method for Delineating Flood-Prone Areas in	W89-02975 5E
spective,	the Great Basin of Nevada and Adjacent States, W89-02500 2E	
W89-02755 6F	W 67-02300 2E	Preliminary Design Report of a 10-MGD Deep
Social Choice and Benefit-Cost Analysis,	FLOODING	Shaft-Flotation Plant for the City of Bangor Maine, USA: Appendix.
W89-02756 6B	Urban Flood Problems: Their Scale and the	W89-02996 5E
Project Associal Persons Allerties and	Policy Response,	
Project Appraisal, Resource Allocation and Public Involvement,	W89-02746 4A	Treatment of Potable Water from Seoul, Kore
W89-02758 6E	Assessing the Health Effects of Floods,	by Flotation, Filtration and Adsorption, W89-03319 51
W 000 Dt . III 000 W 10	W89-02757 2E	W 67-03317
FLOOD PLAIN ZONING Institutional and Policy Context,	Flood Javadeties Modelling Using MII HV	FLOW
W89-02745 6F	Flood Inundation Modelling Using MILHY, W89-03330 2E	Precise Measurement of Microforms and Fabri
	W 07-03330	of Alluvial Cones for Prediction of Landforn Evolution,
Urban Flood Problems: Their Scale and the	FLOODS	W89-02908 2
Policy Response, W89-02746 4A	Sediment Supply, Movement and Storage in an	1777
1107-02/10	Unstable Gravel-Bed River, W89-02436 2J	FLOW CHARACTERISTICS
Power Behind the Flood Scene,	W89-02436 2J	Experimental Study of Flow in Settling Tank W89-03107
W89-02747 6E	Method for Delineating Flood-Prone Areas in	W 89-03107
Development Control Procedures in England	the Great Basin of Nevada and Adjacent States,	FLOW DURATION
and Wales,	W89-02500 2E	
W89-02748 6F	Floods in Central Texas, August 1-4, 1978,	Flow Frequency and Flow Duration of Stream in the Philadelphia Area, Pennsylvania,
Conflicting Objectives in Floodplain Manage-	W89-03025 2E	
ment: Flood Damage Reduction Versus Herit-		
age Preservation,	Hydrology, Geomorphology, and Dam-Break	
W89-02749 6F	Modeling of the July 15, 1982, Lawn Lake Dam and Cascade Lake Dam Failures, Larimer	
Flood Insurance and Floodplain Management,	County, Colorado,	the Enugu Coal-Mine Area, Anambra State, N geria,
W89-02750 6F	W89-03027 8A	

FLOW PROFILE	Bed Load Sampling and Analysis,	FOREST HYDROLOGY
River Dynamics, Flow Regime and Sediment	W89-02434 2J	Rapid Subsurface Flow and Streamflow Solute
Transport, W89-02432 2J	Transport Processes at the Catchment Scale,	Losses in a Mixed Evergreen Forest, New Zea- land.
FLOW RESISTANCE	W89-02437 2J	W89-02890 2G
Roughness Coefficients for Densely Vegetated	Formation of a Coarse Surface Layer as the	Hydrology and Solute Uptake in Hillslope Soils
Flood Plains,	Response to Gravel Mobility,	on Magnesian Limestone: the Whitwell Wood
W89-02502 2E	W89-02440 2J	Project,
FLUCTUATIONS	Concentral Models of Sediment Transport in	W89-02891 2G
Methane Cycling in the Sediments of Lake	Conceptual Models of Sediment Transport in Streams,	C-f101-6 0 60 11
Washington, W89-03249 2H	W89-02443 2J	Surface and Subsurface Sources of Suspended Solids in Forested Drainage Basins in the
	Investigation of Sediment Routing by Size Frac-	Keuper Region of Luxembourg,
FLUIDIZED BED PROCESS Comparison Between Waste Water Treatment in	tions in a Gravel-Bed River,	W89-02892 2J
Completely Mixed and Fluidized Bed Reactors:	W89-02444 2J	Sources of Variation of Soil Erodibility in Wooded Drainage Basins in Luxembourg,
Development and Structure of Biomass (Verg-	Bed Load Discharge Equations for Steep Moun-	W89-02893 2J
leich der Absasserreinigung im Ruhr - und im	tain Rivers,	W 07-02073
Wirbelbettreaktor Sowie Entwicklung und Struktur der Biomasse),	W89-02445 2J	Dynamics of Water Chemistry in Hardwood and
W89-03045 5D	G. F T	Pine Ecosystems,
	Sediment Transport in Step-Pool Streams, W89-02448 2J	W89-02900 2K
Anaerobic Fluidized Bed Treatment of an Indus-	W89-02448 2J	Variable Solute Sources and Hydrological Path-
trial Wastewater,	Hydrologic Data for Computation of Sediment	ways in a Coastal Subalpine Environment,
W89-03162 5D	Discharge, Toutle and North Fork Toutle	W89-02901 2K
FLUORESCENCE	Rivers near Mount St. Helens, Washington,	
Interrelationship Between In Vivo Fluorescence	1980-84.	Forested Wetlands in Freshwater and Salt-
of Phytoplankton and Light Beam Transmission	W89-02571 7C	Water Environments,
with Reference to Fluorescence Yield,	Distribution of Contaminants in Clams and Sedi-	W89-03265 2H
W89-03233 2L	ments from the Huron-Erie Corridor: II. Lead	FOREST MANAGEMENT
Prediction of Reservoir Phytoplankton Condi-	and Cadmium,	Effects of Geology, Runoff, and Land Use on
tion by the Fluorescence Method,	W89-03177 5B	the Stability of the West Gallatin River System,
W89-03291 2H		Gallatin County, Montana,
FLUSHING	New Biological Marker Layer in the Sediments of the Great Lakes: Bythothrephes cederstroemi	W89-02472 4C
Reservoir Sedimentation and Influence of Flush-	(Schodler) Spines,	FOREST SOILS
ing,	W89-03178 2H	Soil Acidification and Metal Solubility in For-
W89-02457 2J		ests of Southern Sweden,
THE ALL CROLLORS HOLD ONLY	Hurricane-Induced Sediment Deposition in a	W89-02308 5E
FLUVIAL GEOMORPHOLOGY Catchment Experiments in Fluvial Geomorpho-	Gulf Coast Marsh,	
logy.	W89-03193 2J	Limits on Cation Leaching of Weakly Podzo-
W89-02880 2E	FOG	lized Forest Soils: An Empirical Evaluation, W89-02310 5E
	Consequences of Cloud Water Deposition on	W 67-02310
Catchment Experiments in Fluvial Geomorpho-	Vegetation at High Elevation,	Hydrology and Solute Uptake in Hillslope Soils
logy: A Review of Objectives and Methodolo- gy,	W89-02305 5B	on Magnesian Limestone: the Whitwell Wood
W89-02881 2E	FOOD CHAINS	Project,
	Metal Speciation and Interactions among Ele-	W89-02891 2G
Controls on Overland Flow Generation,	ments Affect Trace Element Transfer in Agri-	Interactions of Organic Matter and Aluminum
W89-02882 2E	cultural and Environmental Food-Chains,	Ions in Acid Forest Soil Solutions: Metal Com
Spatial Variability of Soil Hydrodynamic Prop-	W89-02650 5B	plexation, Flocculation, and Precipitation,
erties in the Petite Fecht Catchment, Soultzeren,	M. A. H. W. L. L. W. L. M	W89-03126 2K
France - Preliminary Results,	Microflagellate-Picoplankton Food Linkage in the Water Column of Lake Biwa,	FOREST WATERSHEDS
W89-02883 2G	W89-03245 2H	Sources of Variation of Soil Erodibility in
Pipeflow and Pipe Erosion in the Maesnant Ex-	W 65-03243	Wooded Drainage Basins in Luxembourg,
perimental Catchment,	Production and Use of Detritus in Various	W89-02893 2
W89-02884 2E	Freshwater, Estuarine, and Coastal Marine Eco-	
	systems,	Monitoring Baseline Suspended Sediment in
Floodplain Response of a Small Tropical Stream.	W89-03266 2H	Forested Basins: The Effects of Sampling or
W89-02885 2E	FOOD PROCESSING INDUSTRY	Suspended Sediment Rating Curves, W89-03053 2
7702003	Synergistic Approach to Physical-Chemical	W 89-03033
Pattern of Wash Erosion Around an Upland	Wastewater Pretreatment in the Food Industry,	Forested Wetlands in Freshwater and Salt
Stream Head,	W89-02802 5D	Water Environments,
W89-02886 2J		W89-03265 2F
Runoff and Sediment Production in a Small	FOOD-PROCESSING WASTES	FORESTS
Peat-Covered Catchment: Some Preliminary Re-	Synergistic Approach to Physical-Chemical Wastewater Pretreatment in the Food Industry,	Effects of Atmospheric Pollutants on Forest
sults,	W89-02802 5D	Wetlands and Agricultural Ecosystems.
W89-02888 2E		W89-02304 51
Some Implications of Small Catchment Solute	Influence of Na and Ca Alkalinity on UASB	
Studies for Geomorphological Research,	Treatment of Olive Mill Effluents: I. Preliminary	Forested Wetlands in Freshwater and Salt
W89-02902 2E	Results,	Water Environments,
	W89-03116 5D	W89-03265 21
FLUVIAL SEDIMENTS Sediment Transport in Gravel-Bed Rivers.	FORECASTING	FOX RIVER
W89-02430 2J	Projections of Water Availability in the Lower	Intensive Survey of the Fox River Basin from
	Rio Grande, Gila-San Francisco and Mimbres	the Wisconsin State Line to Ottawa, Illinoi
River Bed Gravels: Sampling and Analysis,	Drainage Basins to 2005,	1982.
W89-02433 7B	W89-02474 6D	W89-02841 56

FRACTURE PERMEABILITY

FRACTURE PERMEABILITY	GAS PIPELINES Effects of Gas-Pipeline Construction on the	Mass Balance of Heavy Metals in the Seto Inland Sea, Japan,
Groundwater Contamination at a Landfill Sited on Fractured Carbonate and Shale,	Aquatic Ecosystem of Canada Creek, Presque	W89-03278 5B
W89-03146 5B	Isle County, Michigan, W89-02861 4C	GEOHYDROLOGY
FRANCE	110702001	Proceedings of the FOCUS Conference on
Spatial Variability of Soil Hydrodynamic Prop-	GASOLINE	Southwestern Ground Water Issues.
erties in the Petite Fecht Catchment, Soultzeren, France - Preliminary Results,	In-Situ Hydrocarbon Extraction, A Case Study, W89-02354 5G	W89-02331 2F
W89-02883 2G	Design and Construction of a Subsurface Gaso-	Transition from Ground-Water Mining to In-
FREEZE-THAW CYCLE	line Recovery System Westminster, Colorado,	duced Recharge in Generalized Hydrogeologic Systems,
Microerosion Processes and Sediment Mobiliza-	W89-02357 5G	W89-02337 4B
tion in a Roadbank Gully Catchment in Central	Modeling Groundwater Transport of Dissolved	
Oklahoma, W89-02894 2J	Gasoline and Using the Results to Evaluate Aq- uifer Restoration Processes,	Impact of the Newport-Inglewood Structural Zone on Hydrogeologic Mitigation Efforts: Los
FREQUENCY ANALYSIS	W89-03321 5B	Angeles Basin, California,
Techniques for Estimating Regional Flood	GENOTOXICITY	W89-02342 2F
Characteristics of Small Rural Watersheds in the Plains Region of Eastern Colorado, W89-02507 2E	In Vitro Genotoxicity of Chlorinated Drinking Water Processed from Humus-Rich Surface	Measurement of Groundwater Velocity with a Colorimetric Borehole Dilution Instrument,
W89-02507 2E	Water, W89-03202 5C	W89-02345 7B
FROST		Hydrogeological Mapping in Asia and the Pacif-
Modelling Seasonally Freezing Ground Condi-	GEOCHEMISTRY	ic Region.
tions, W89-03331 2C	Concept of Electron Activity and its Relation to Redox Potentials in Aqueous Geochemical Sys-	W89-02364 7B
FROST ACTION	tems, W89-02580 2K	Assessment and Mapping of Australia's Ground-
Microerosion Processes and Sediment Mobiliza-		water Resources, W89-02365 2F
tion in a Roadbank Gully Catchment in Central	Geophysical Logs and Hydrological Data for	W 69-02303
Oklahoma, W89-02894 2J	Eight Wells in the Coyote Spring Valley Area, Clark and Lincoln Counties, Nevada,	Hydrogeological Development in Vanuatu,
W89-02894 2J	W89-02603 4B	W89-02368 2F
FROZEN GROUND	Controls on the Composition of Authigenia Bas	Development and Achievements of Hydrogeo-
Modelling Seasonally Freezing Ground Condi-	Controls on the Composition of Authigenic Per- colation Water in the Burren, Ireland,	logical Mapping in China,
tions, W89-03331 2C	W89-02730 2K	W89-02370 2F
FUNGI	Chemical Weathering of the East Yorkshire	Groundwater in China,
Bacteria and Fungi,	Chalk, W89-02731 2K	W89-02371 2F
W89-02769 7B	W89-02/31	Groundwater Resources Development and Man-
FUTURE PLANNING	Hydrochemical Characteristics of a Dartmoor	agement in India,
Hydrology 2000.	Hillslope, W89-02903 2E	W89-02373 2F
W89-02717 2A		Notes on the Hydrogeological Map of Sarawak
GAGING	Characterization of Colloids in Groundwater, W89-02998 2K	W89-02378 2F
Pre-Feasibility on Streamflow Gauging Using Radioisotope Tracer Method for Kemumbu Ag-	Hydrogeochemistry of the Upper Part of the	Water Resources and Hydrogeological Mapping
riculture Development Authority (KADA),	Fort Union Group in the Gascoyne Lignite	in the Mongolian People's Republic, W89-02379 2F
W89-02713 2E	Strip-Mining Area, North Dakota,	W89-02379 2F
GAGING STATIONS	W89-03026 4C	International Legend for Hydrogeological
History of Annual Streamflows from the 21	Hydrology and Chemistry of Selected Prairie	Maps: Principles and Application,
Water Resources Regions in the United States and Puerto Rico, 1951-83,	Wetlands in the Cottonwood Lake Area, Stutsman County, North Dakota, 1979-82,	W89-02386 7E Hydrology of Area 62, Northern Great Plain
W89-02493 7C	W89-03035 2H	and Rocky Mountain Coal Provinces-New
GALLATIN RIVER	Migration of Acidic Groundwater Seepage from	Mexico and Arizona,
Effects of Geology, Runoff, and Land Use on	Uranium-Tailings Impoundments: 2. Geochemi-	W89-02498 21
the Stability of the West Gallatin River System,	cal Behavior of Radionuclides in Groundwater, W89-03038 5B	Hydrology of Area 59, Northern Great Plain
Gallatin County, Montana, W89-02472 4C		and Rocky Mountain Coal Provinces, Colorado
	Migration of Acidic Groundwater Seepage from	and Wyoming,
GAMMA RADIATION	Uranium-Tailings Impoundments: 3. Simulations of the Conceptual Model with Application to	W89-02501 21
Distribution of Gamma-emitting Radionuclides in Surface Subtidal Sediments Near the Sella-	Seepage Area A,	Potentiometric Surface of the Upper Florida
field Plant,	W89-03039 5B	Aquifer in the St. Johns River Water Manage
W89-03190 5B	Atmospheric, Geological, Marine, and Anthro-	ment District and Vicinity, Florida, Septembe
GAS CHROMATOGRAPHY	pogenic Effects on Groundwater Quality in Fin-	1987, W89-02503
Analysis of Volatile Halogenated Hydrocarbons	land,	
on the ppq Scale,	W89-03076 5B	Hydrology of Area 31, Eastern Region, Interio
W89-03301 5A	Deminication in Treshwater and Coustain	Coal Province, Illinois and Indiana, W89-02508 5
GAS LIQUID CHROMATOGRAPHY	Marine Ecosystems: Ecological and Geochemi-	H 07-02300
Capillary Gas Chromatographic Determination		Construction, Geologic, and Hydrologic Da
of Amitrole in Water with Alkali Flame Ioniza-		for Observation wells in the Reelioot Las
tion Detection, W89-03287 5A	Factors Controlling the Biogeochemical Cycles	
	of Trace Elements in Fresh and Coastal Marine Waters as Revealed by Artificial Radioisotopes,	
GAS MANUFACTURING	W89_03263 2H	Development of Groundwater Resources in the
U.S. Production of Manufactured Gases: Assess ment of Past Disposal Practices,		Orange County Area, Texas and Louisian 1980-Spring of 1985,
W89-02964 5E	Iodine Speciation in Chesapeake Bay Waters W89-03277 2L	

Relation of Water Chemistry of the Edwards Aquifer to Hydrogeology and Land Use, San	Dakota, South Dakota, and Wyoming: Summa- ry, W89-03033 2F	Controls on Overland Flow Generation, W89-02882 2E
Antonio Region, Texas, W89-02514 5B		Pipeflow and Pipe Erosion in the Maesnant Ex-
Hydrogeology of the Socorro and La Jencia	Summary of the Hydrology of the Floridan Aq- uifer System in Florida and in Parts of Georgia,	perimental Catchment, W89-02884 2E
Basins, Socorro County, New Mexico,	South Carolina, and Alabama,	
W89-02517 2F	W89-03034 2F	Floodplain Response of a Small Tropical Stream,
Groundwater Withdrawals and Changes in Groundwater Quality and Land Surface Subsid-	GEOHYRDOLOGY Vulnerability Study of the Aubergenville Aqui-	W89-02885 2E
ence in the Houston District, Texas,	fer,	Pattern of Wash Erosion Around an Upland
W89-02519 6G	W89-03077 5B	Stream Head, W89-02886 2J
Selected Hydrogeologic Data for the Southwest	GEOLOGIC FRACTURES	
Glendive Preliminary Logical Mining Unit and Adjacent Areas, Dawson County, Montana,	Solute Transport in Fractured Rocks, W89-03014 2F	Runoff and Sediment Transport Dynamics in Canadian Badland Micro-Catchments,
W89-02531 7C	GEOLOGIC MAPPING	W89-02887 2E
Selected Geohydrologic Characteristics of the	Geology of the Fresh Ground-Water Basin of	Runoff and Sediment Production in a Small
Patapsco Aquifer at Chalk Point, Prince Georges County, Maryland,	the Central Valley, California, with Texture	Peat-Covered Catchment: Some Preliminary Re-
W89-02560 2F	Maps and Sections, W89-03032 2F	sults, W89-02888 2E
Selected Groundwater Information for the Co-	GEOLOGIC STRUCTURE	
lumbia Plateau Regional Aquifer System, Wash-	Geological Structure: An Important Factor	Surface and Subsurface Sources of Suspended Solids in Forested Drainage Basins in the
ington and Oregon, 1982-1985: Volume I, Geo-	Controlling Karst Development,	Keuper Region of Luxembourg,
hydrology, W89-02572 7C	W89-02733 2F	W89-02892 2J
Hydrologic Analysis of the Rio Grande Basin	GEOLOGY	Sources of Variation of Soil Erodibility in
North of Embudo, New Mexico, Colorado and	Hydrogeological Mapping in the Philippines, W89-02382 2F	Wooded Drainage Basins in Luxembourg, W89-02893 2J
New Mexico, W89-02589 2F	Hudrogeological Manning in the Socialist De	
	Hydrogeological Mapping in the Socialist Re- public of Vietnam,	Water and Sediment Dynamics of the Homerka Catchment.
Groundwater Hydrology, W89-02720 2F	W89-02385 4B	W89-02895 2J
New Directions in Karst.	Geological Structure: An Important Factor	Sources of Sediment and Channel Changes in
W89-02728 2F	Controlling Karst Development, W89-02733 2F	Small Catchments of Romania's Hilly Regions,
Geological Structure: An Important Factor		W89-02896 2J
Controlling Karst Development,	GEOMEMBRANE Geomembrane Liner Reduces Leakage in Un-	Landsliding, Slope Development and Sediment
W89-02733 2F	derground Reservoir,	Yield in a Temperate Environment: Northeast Romania,
Experimental Geomorphology (Drainage Net-	W89-03281 5F	W89-02897 2J
work, Piedmont and Channel Morphology), W89-02847 2J	GEOMORPHOLOGY	Development of Field Techniques for Assess-
	Assessment of Hydrogeological Features Using the Technique of Terrain Classification,	ment of River Erosion and Deposition in Mid-
Mathematical Models for Interpretation of Tracer Data in Groundwater Hydrology.	W89-02372 7B	Wales, UK, W89-02898 2J
W89-03009 2F	Differences Between Gravel- and Sand-bed	
Role of Tracer Methods in Hydrology as a	Rivers,	Suspended Sediment Properties and Their Geo- morphological Significance,
Source of Physical Information: Basic Concepts and Definitions, Time Relationship in Dynamic	W89-02431 2J	W89-02899 2J
Systems,	Sediment Supply to Upland Streams: Influence	Dynamics of Water Chemistry in Hardwood and
W89-03010 7B	on Channel Adjustment, W89-02435 2J	Pine Ecosystems,
General Review of Methodologies and Ap-	Sediment Supply, Movement and Storage in an	W89-02900 2K
proaches in Mathematical Models for Interpreta- tion of Tracer Data in Hydrology,	Unstable Gravel-Bed River,	Variable Solute Sources and Hydrological Path- ways in a Coastal Subalpine Environment,
W89-03011 2F	W89-02436 2J	W89-02901 2K
Review of Existing Mathematical Models for	Sediment Balance Considerations Linking Long-	Some Implications of Small Catchment Solute
Interpretation of Tracer Data in Hydrology,	Term Transport and Channel Processes, W89-02438 2J	Studies for Geomorphological Research,
W89-03012 2F		W89-02902 2E
Solute Transport in Fractured Rocks, W89-03014 2F	Limestone Weathering Under a Soil Cover and the Evolution of Limestone Pavements, Malham	Hydrochemical Characteristics of a Dartmoor
	District, North Yorkshire, UK,	Hillslope, W89-02903 2E
Use of Linear Compartmental Simulation Ap- proach for Quantitative Interpretation of Isotope	W89-02740 2J	
Data under Time Variant Flow Conditions,	Valley Excavation in the Yorkshire Dales Karst,	Magnitude and Frequency Characteristics of Suspended Sediment Transport in Devon
W89-03017 7C	W89-02742 2F	Rivers,
Hydrogeochemistry of the Upper Part of the Fort Union Group in the Gascoyne Lignite	Experimental Geomorphology (Drainage Net- work, Piedmont and Channel Morphology),	W89-02904 2J
Strip-Mining Area, North Dakota,	W89-02847 2J	Relationship Between Soil Creep Rate and Cer-
W89-03026 4C	Catchment Experiments in Fluvial Geomorpho-	tain Controlling Variables in a Catchment in Upper Weardale, Northern England,
Geology of the Fresh Ground-Water Basin of	logy.	W89-02905 2J
the Central Valley, California, with Texture Maps and Sections,	W89-02880 2E	Patterns of Hillslope Solutional Denudation in
W89-03032 2F	Catchment Experiments in Fluvial Geomorpho-	Relation to the Spatial Distribution of Soil Mois- ture and Soil Chemistry over a Hillslope Hollow
Regional Aquifer System Underlying the North-	logy: A Review of Objectives and Methodolo- gy,	and Spur,
ern Great Plains in Parts of Montana, North	W89-02881 2E	W89-02906 2J

GEOMORPHOLOGY

Some Relationships Between Debris Flow Motion and Micro-Topography for the Kamika- mihori Fan, North Japan Alps, W89-02907 2J	GRANULAR ACTIVATED CARBON Experiences with Granular Activated Carbon Filtration and On-Site Reactivation at Jefferson Parish, Louisiana,	GREENHOUSE EFFECT Potential Impacts of a Scenario of CO2-Induced Climatic Change on Ontario, Canada, W89-03063 2A
Precise Measurement of Microforms and Fabric	W89-02790 5F	Response of Coastal Plants to Increase in Sub-
of Alluvial Cones for Prediction of Landform Evolution,	GRASSED WATERWAYS Design of Reinforced Grass Waterways,	mergence and Salinity, W89-03188 2L
W89-02908 2J Flow Processes and River Channel Morpholo-	W89-02859 8A	GREENHOUSE EFFECTS CO2-Induced Changes in Seasonal Snow Cover
By. W89-02910 2J	GRAVEL River Bed Gravels: Sampling and Analysis,	Simulated by the OSU Coupled Atmospheric- Ocean General Circulation Model,
Influence of Vegetation on Stream Channel	W89-02433 7B	W89-02629 2C
Processes, W89-02911 2J	Formation of a Coarse Surface Layer as the Response to Gravel Mobility, W89-02440 2J	GROUNDWATER Hydrogeological Mapping in Asia and the Pacif- ic Pacific
Stream Response to Flash Floods in Upland	GREAT BASIN	ic Region. W89-02364 7B
Scotland, W89-02912 2E	Method for Delineating Flood-Prone Areas in the Great Basin of Nevada and Adjacent States,	Assessment and Mapping of Australia's Ground-
Experimental Method in Geomorphology, W89-02913 2E	W89-02500 2E	water Resources, W89-02365 2F
	GREAT BRITAIN	Hydrogeological Mapping in Fiji,
Hydrology, Geomorphology, and Dam-Break Modeling of the July 15, 1982, Lawn Lake Dam and Cascade Lake Dam Failures, Larimer	Flood Hazard Management: British and Interna- tional Perspectives.	W89-02366 2F
County, Colorado, W89-03027 8A	W89-02743 4A	Groundwater in China, W89-02371 2F
	Flood Problem in Perspective, W89-02744 4A	Groundwater Resources Development and Man-
GEOPHYSICS Improved Fresh Water Assessment in Sand	Flood Insurance and Floodplain Management,	agement in India, W89-02373 2F
Aquifers Utilizing Geophysical Well Logs, W89-02347 2F	W89-02750 6F	Hydrogeological Problems of Hard Rock Areas
	Flood Warning Dissemination: The British Ex-	of Southern India,
Seismic Refraction Tests Above Water Table, W89-03113 7A	perience, W89-02753 6F	W89-02374 2F
GEORGIA	GREAT LAKES	Status of Hydrogeological Mapping in Indonesia in 1983,
Fiscal Year 1987 Report (Georgia Water Re-	Gas Chromatographic Residue Patterns of Toxa-	W89-02375 7B
sources Research Institute), W89-02553 9D	phene in Fish Samples from the Great Lakes and from Rivers of the Southeastern United States,	Review of Groundwater in the Republic of
Simulation of Flood Hydrographs for Georgia Streams,	W89-02328 5B	Korea, W89-02376 2F
W89-03002 5E	Design of a Great Lakes Atmospheric Inputs and Sources (GLAIS) Network,	Status of Hydrogeological Mapping in Peninsular Malaysia,
Summary of the Hydrology of the Floridan Aq- uifer System in Florida and in Parts of Georgia,	W89-02418 7A	W89-02377 2F
South Carolina, and Alabama, W89-03034 2F	Potential Impacts of a Scenario of CO2-Induced Climatic Change on Ontario, Canada,	Notes on the Hydrogeological Map of Sarawak, W89-02378 2F
GEOTHERMAL RESOURCES	W89-03063 2A	Water Resources and Hydrogeological Mapping
Reconnaissance of the Hydrothermal Resources of Utah,	Distribution of Contaminants in Clams and Sedi- ments from the Huron-Erie Corridor: II. Lead	in the Mongolian People's Republic, W89-02379 2F
W89-03020 2F	and Cadmium, W89-03177 5B	PakistanStatus Report,
GEOTHERMAL WATER	W 67-031//	W89-02381 4B
Supplemental Arsenic Data for Selected Streams in the Missouri River Basin, Montana, 1987, W89-02516 5B	New Biological Marker Layer in the Sediments of the Great Lakes: Bythothrephes cederstroemi (Schodler) Spines,	Hydrogeological Mapping in the Philippines, W89-02382 2F
GLACIATION	W89-03178 2H	Development of Groundwater Resources in Sri
Glacio-Eustatic Sea-Level Control on Red Sea Salinity,	Utility of Soluble Reactive Phosphorus Meas-	Lanka, W89-02383 4B
W89-03119 2L	urements in Great Lakes Surveillance Programs: A Summary,	Data Requirements for Hydrogeological Maps,
GLACIERS	W89-03180 5A	W89-02387 7A
Surface Topography of the Lower Part of Co- lumbia Glacier, Alaska, 1974-81, W89-03021 2C	Silica and Phosphorus Flux from Sediments: Importance of Internal Recycling in Lake Michi-	Hydrogeological Mapping in Coastal Areas, W89-02390 2F
	gan,	Groundwater Levels in Wyoming, 1978
Bed Topography Inferred From Airborne Radio-Echo Sounding of Columbia Glacier,	W89-03219 2H	Through September 1987,
Alaska, W89-03022 2C	Dynamics of Lake Michigan Phytoplankton: Re- lationship to Nitrogen and Silica Fluxes,	Water Programme of Wolsonth County South
GLACIOHYDROLOGY	W89-03230 2H	Water Resources of Walworth County, South Dakota,
Glacio-Eustatic Sea-Level Control on Red Sea Salinity,	GREAT PLAINS Water Conservation for More Crop Production	W89-02489 2F
W89-03119 2L	in the Great Plains,	Groundwater Resources of Rusk County, Texas W89-02491 2F
GLEN CANYON DAM	W89-02657 3F	Groundwater Data for Michigan-1986,
Effects of Steady versus Fluctuating Flows on Aquatic Macroinvertebrates in the Colorado	GREAT SALT LAKE Rising Level of the Great Salt Lake: Impacts	W89-02495 7C
River below Glen Canyon Dam, Arizona, W89-02940 6G	and Adjustments, W89-03127 6F	Potentiometric Surface of the Upper Floridan
00	W89-03127 6F	Aquifer in the St. Johns River Water Manage

ment District and Vicinity, Florida, September 1987, W89-02503 7C	Data on Groundwater Quality for the Southern Nevada Part of the Kingman One Degree X Two Degree Quadrangle,	Atmospheric, Geological, Marine, and Anthro- pogenic Effects on Groundwater Quality in Fin- land,
	W89-02546 7C	W89-03076 5B
Pumpage of Water in Louisiana, 1985, W89-02506 6D	Water Resources Investigations in Tennessee:	Microbial Activity in Sanitary Landfills: A Pos-
Hydrology of Area 31, Eastern Region, Interior	Programs and Activities of the U.S. Geological Survey, 1987-1988,	sible Source of the Humic Substances in Groundwater.
Coal Province, Illinois and Indiana, W89-02508 5B	W89-02559 7C	W89-03079 5B
Construction, Geologic, and Hydrologic Data for Observation Wells in the Reelfoot Lake	Water Resources Investigations in Tennessee: Programs and Activities of the U.S. Geological	Aquifer Thermal Energy Storage in Finland, W89-03082 4B
Area, Tennessee and Kentucky, W89-02510 7B	Survey, 1987-1988, W89-02570 9C	Ground Water: A Living Ecosystem, W89-03084 2F
Groundwater Withdrawals and Changes in	Water Resources Activities of the U. S. Geologi-	
Groundwater Quality and Land Surface Subsidence in the Houston District, Texas,	cal Survey in Texas - Fiscal Year 1987, W89-02574 9C	Biochemical Testing of Groundwater, W89-03085 5A
W89-02519 6G	Water Level Measurements 1981-85 and Chemi- cal Analyses 1978-85, Red River Alluvial Aqui-	Utilization of Biological Methods in Groundwater Treatment,
Groundwater Levels in Wyoming, 1976 Through 1985,	fer, Red River Valley, Louisiana,	W89-03088 5F
W89-02525 7C	W89-02582 7C	Clogging Problems in Groundwater Heat Pump
Data on Groundwater Quality for the Millett 1	Groundwater Resources of Limestone County,	Systems in Sweden,
Degree X 2 Degree Quadrangle, Central Nevada,	Texas, W89-02583 2F	W89-03089 2F
W89-02533 7C		Treatment of Groundwater with Slow Sand Fil-
Data on Groundwater Quality for the Elko 1	January 1987 Water Levels, and Data Related to Water Level Changes, Western and South-Cen-	tration, W89-03090 5F
Degree X 2 Degree Quadrangle, Eastern	tral Kansas,	
Nevada, W89-02534 7C	W89-02594 2F	VYREDOX and NITREDOX Methods of In situ Treatment of Groundwater,
	Ground Water Quality and Agricultural Prac- tices.	W89-03091 5F
Data on Groundwater Quality for the Ely 1 Degree X 2 Degree Quadrangle, Eastern	W89-02654 3F	Modelling of Flow and Transport Processes in
Nevada,	U.S.D.A. Agricultural Research Service Com-	Vyredox and Nitredox Subsurface Treatment
W89-02535 7C	mitment to Ground Water Research,	Plants, W89-03092 5F
Data on Groundwater Quality for the Lund 1 Degree X 2 Degree Quadrangle, Eastern	W89-02655 3F	Biotechnology for Manganese Removal from
Nevada,	Ground Water Conservation Techniques: Poten-	Groundwater,
W89-02536 7C	tial Impacts on Water Usage and Quality, W89-02658 3F	W89-03093 5F
Data on Groundwater Quality for the McDer-	Conjunctive Use of Surface and Ground Water	Biological Treatment of Groundwater in Basins
mitt One Degree X Two Degree Quadrangle, Northern Nevada,	in the South Platte, River Basin: A Case Study	with Floating Filters: I. Test Arrangements and General Results,
W89-02537 7C	of the Central Colorado Water Conservancy District.	W89-03094 5F
Data on Groundwater Quality for the Lovelock	W89-02659 6D	Biological Treatment of Groundwater in Basins
One Degree X Two Degree Quadrangle, West- ern Nevada,	Effects of Irrigation Practices on Stream-Con-	with Floating Filters: II. The Role of Microor- ganisms in Floating Filters,
W89-02538 7C	nected Phreatic Aquifer Systems, W89-02661 3F	W89-03095 5G
Data on Groundwater Quality for the Winne-		Biological Groundwater Denitrification: Labo-
mucca One Degree X Two Degree Quadrangle, Central Nevada,	Ground Water and Agriculture: Addressing the Information Needs of Pennsylvania's Chesa-	ratory Studies,
W89-02539 7C	peake Bay Program,	W89-03096 5F
Data on Groundwater Quality for the Reno One	W89-02680 5G	In Situ Biological Groundwater Denitrification:
Degree X Two Degree Quadrangle, Western	Groundwater Hydrology,	Concepts and Preliminary Field Tests, W89-03097 5G
Nevada, W89-02540 7C	W89-02720 2F	Problems in Czechoslovakia Regarding Methods
Data on Groundwater Quality for the Walker	Influence of Ground Water on Soil-Structure Interaction,	of Removal of Nitrates from Drinking Water,
Lake One Degree X Two Degree Quadrangle,	W89-02850 2F	W89-03098 5D
Western Nevada and Eastern California, W89-02541 7C	Quality of Ground Water in the Payette River	Simulations of Physical Nonequilibrium Solute Transport Models: Application to a Large-Scale
Data on Groundwater Quality for the Tonopah	Basin, Idaho, W89-03008 5G	Field Experiment,
One Degree X Two Degree Quadrangle, Cen-		W89-03148 2F
tral Nevada, W89-02542 7C	Mathematical Models for Interpretation of Tracer Data in Groundwater Hydrology.	GROUNDWATER *AGRONOMY
Data on Groundwater Quality for the Western	W89-03009 2F	Assessing Some Potentials for Changing Agro- nomic Practices and Improving Ground Water
Nevada Part of the Goldfield One Degree X	Role of Tracer Methods in Hydrology as a	Quality: Implications from a 1984 Iowa Survey,
Two Degree Quadrangle, W89-02543 7C	Source of Physical Information: Basic Concepts and Definitions, Time Relationship in Dynamic	W89-02669 5G
	Systems,	GROUNDWATER AVAILABILITY
Data on Groundwater Quality for the Caliente One Degree X Two Degree Quadrangle, East-	W89-03010 7B	Assessment and Mapping of Australia's Ground- water Resources,
ern Nevada,	Identification of a Karst Hydrological System in the Dinaric Karst (Yugoslavia),	W89-02365 2F
	W89-03052 2F	Hydrogeological Development in Vanuatu,
Data on Groundwater Quality for the Western Nevada Part of the Death Valley One Degree X	Groundwater Microbiology: Problems and Bio-	W89-02368 2F
Two Degree Quadrangle,	logical Treatment: State-of-the-Art Report,	Water-Bearing Zones in the Mining Area of the
W89-02545 7C	W89-03075 2F	Northern Region of Bangladesh with Regard to

GROUNDWATER AVAILABILITY

*****	Calanted Considerates Information for the Co	GROUNDWATER LEVELS
Utilization of Mine Water for Irrigation and	Selected Groundwater Information for the Co-	
Other Uses,	lumbia Plateau Regional Aquifer System, Wash-	Development of Groundwater Resources in the
W89-02369 2F	ington and Oregon, 1982-1985: Volume I, Geo-	Orange County Area, Texas and Louisiana,
	hydrology,	1980-Spring of 1985,
Development and Achievements of Hydrogeolo-	W89-02572 7C	W89-02513 2F
gical Mapping in China,		
W89-02370 2F	Selected Groundwater Information for the Co-	GROUNDWATER MANAGEMENT
	lumbia Plateau Regional Aquifer System, Wash-	Proceedings of the FOCUS Conference on
Groundwater in China,	ington and Oregon, 1982-1985: Volume II,	Southwestern Ground Water Issues.
W89-02371 2F	Water Levels,	W89-02331 2F
	W89-02573 7C	
Groundwater Resources Development and Man-		Use of a Regional Ground-Water Flow Model
agement in India,	Water Level Measurements 1981-85 and Chemi-	for Water Rights Administration in a Southwest
W89-02373 2F	cal Analyses 1978-85, Red River Alluvial Aqui-	Alluvial Basin,
	fer, Red River Valley, Louisiana,	W89-02332 4B
Hydrogeological Problems of Hard Rock Areas	W89-02582 7C	W 87-02332 4B
of Southern India,	W89-02382 /C	Assessment of the Adequacy of the Ground-
W89-02374 2F	GROUNDWATER DEPLETION	Water Monitoring System for Artificial Re-
Review of Groundwater in the Republic of	Land and Water Management Issues: Texas	charge of Aquifers in the Los Angeles Area,
Korea,	High Plains,	California,
W89-02376 2F	W89-02634 6D	W89-02335 7A
Status of Hydrogeological Mapping in Peninsu-	GROUNDWATER EXPLORATION	Impacts of Recharge Legislation on Groundwat-
lar Malaysia,	Seismic Refraction Tests Above Water Table,	er Management in Arizona,
W89-02377 2F	W89-03113 7A	W89-02336 4B
1107 02011		
Notes on the Hydrogeological Map of Sarawak,	GROUNDWATER HYDROGRAPHS	Transition from Ground-Water Mining to In-
W89-02378 2F	Groundwater Data for Michigan-1986,	duced Recharge in Generalized Hydrogeologic
1107-04376		Systems,
Water Resources and Hydrogeological Mapping	W89-02495 7C	W89-02337 4B
in the Mongolian People's Republic,	CROUNDIVATED UNDBOLOCY	W 65-02557
W89-02379 2F	GROUNDWATER HYDROLOGY	Simulating Underground Mines in a Regional
W89-023/9 2F	Hydrologic and Geologic Data for the Edwards	Model,
Hydrogeology of the Butwal-Bhairahwa Area,	Aquifer Recharge Zone Near Georgetown, Wil-	
	liamson County, Texas, 1986-87,	W89-02339 4C
Lumbini Zone, Nepal,	W89-02499 2F	D1 44 '5 D 1 1 D 1 40
W89-02380 2F		Role of Aquifer Testing in Design of Constant-
211. 2. 2	GROUNDWATER LEVEL	Head Extraction Systems,
PakistanStatus Report,	Recovery of Moisture/Solute Profiles in Re-	W89-02346 7B
W89-02381 4B	claimed Coal-Mine Spoil, Northwest New	
		Advisory System for North Carolina Ground-
Hydrogeological Mapping in the Philippines,	Mexico,	water Quality Modeling and Management
W89-02382 2F	W89-02360 2F	Needs,
		W89-02548 5G
Development of Groundwater Resources in Sri	Evapotranspiration of Phreatophytes in the San	
Lanka,	Luis Valley, Colorado,	Saline Seep on Wheatland in Northwest Oklaho-
W89-02383 4B	W89-02478 2D	ma,
		W89-02672 5B
International Legend for Hydrogeological	Evapotranspiration of Native Vegetation in the	W 07-02012
Maps: Principles and Application,	Closed Basin of the San Luis Valley, Colorado,	GROUNDWATER MINING
W89-02386 7B	W89-02481 2D	
	11 07-02401	Land and Water Management Issues: Texas
Hydrogeological Mapping in Coastal Areas,	Records of Wells and Chemical Analyses of	High Plains,
W89-02390 2F		W89-02634 6D
110702070	Groundwater in Hand and Hyde Counties South	
Groundwater Resources of Rusk County, Texas,	Dakota,	GROUNDWATER MONITORING
W89-02491 2F	W89-02505 2F	Proceedings of the FOCUS Conference on
W 03-02451		Southwestern Ground Water Issues.
GROUNDWATER BASINS	Description of Piezometer Nests and Water	W89-02331 2F
	Levels in the Rio Grande Valley Near Albu-	W 65-02331
Ground Water Recharge for Oklahoma: An	querque, Bernalillo County, New Mexico,	Assessment of the Adequacy of the Ground-
Analysis of Past and Future Methodology,	W89-02509 2F	Water Monitoring System for Artificial Re-
W89-02660 4B	24	
Goolean of the Fresh County Water P	Groundwater Levels in the Alluvial Aquifer in	charge of Aquifers in the Los Angeles Area,
Geology of the Fresh Ground-Water Basin of	Eastern Arkansas, 1986,	California,
the Central Valley, California, with Texture	W89-02522 2F	W89-02335 7A
Maps and Sections,	11 07-02322 25	I and a contract of the contra
W89-03032 2F	Effects of Fluctuating River-Pool Stages on	Impact of the Newport-Inglewood Structural
		Zone on Hydrogeologic Mitigation Efforts: Los
GROUNDWATER CHEMISTRY	Groundwater Levels in the Adjacent Alluvial	Angeles Basin, California,
Characterization of Colloids in Groundwater,	Aquifer in the Lower Arkansas River, Arkansas,	W89-02342 2F
W89-02998 2K	W89-02561 2F	
		Statewide Groundwater Quality Monitoring
GROUNDWATER CONTAMINATION	Selected Groundwater Information for the Co-	Network Design,
Selected Water-Quality Data for the Murtaugh	lumbia Plateau Regional Aquifer System, Wash-	W89-02343 5A
Lake Area, South Central Idaho, June 1987,	ington and Oregon, 1982-1985: Volume II,	
W89-02530 7C	Water Levels,	Field Simulation of Waste Impoundment Seep-
	W89-02573 7C	age in the Vadose Zone,
GROUNDWATER DATA		W89-02348 5B
Records of Wells, Drillers' Logs, Water Level	Generalized Potentiometric Surface of the	
Measurements, and Chemical Analyses of	Sparta-Memphis Aquifer, Eastern Arkansas,	Applying Electrical Resistance Blocks for Un-
Groundwater in Harris and Galveston Counties,	Spring 1980,	saturated Zone Monitoring at Arid Sites,
Texas 1980-84,		
	W89-02575 7C	W89-02352 7B
W89-02497 7C	Effects of Future Ground-Water Pumpage on	GROUNDWATER MOVEMENT
Flacted Hudeologic Date for Debugget 17 11		
Elected Hydrologic Data for Pahvant Valley	the High Plains Aquifer in Parts of Colorado,	Use of a Regional Ground-Water Flow Model
and Adjacent Areas, Millard County, Utah,	Kansas, Nebraska, New Mexico, Oklahoma,	for Water Rights Administration in a Southwest
1987,	South Dakota, Texas, and Wyoming,	Alluvial Basin,
W89-02569 7C	W89-03031 2F	W89_02332

Simulating Underground Mines in a Regional Model,	Solute Transport in Fractured Rocks, W89-03014 2F	Hydrogeologic and Geochemical Aspects of Contaminant Transport at the Falls City, Texas
W89-02339 4C		UMTRA Site,
Measurement of Groundwater Velocity with a	Computer Modelling of Confined Aquifer Sys- tems for Interpretation of Chemical and Envi-	W89-02362 5B
Colorimetric Borehole Dilution Instrument,	ronmental Isotope Data,	Effects of Acid Mine Drainage on Groundwater
W89-02345 7B	W89-03015 2F	Quality at the Leviathan Sulfur Mine, Alpine
Role of Aquifer Testing in Design of Constant-	Application of a Transport-Diffusion Model to a	County, California, W89-02363 5C
Head Extraction Systems,	Coastal Aquifer Utilizing In situ Measurements	
W89-02346 7B	of Dispersivity, W89-03016 2F	Waste Water Reduction in Metal Fabrications Operations,
Proceedings, Seventeenth Mississippi Water Re-	W89-03016 2F	W89-02405 5D
sources Conference, 25-26 March, 1987, Jackson,	Use of Linear Compartmental Simulation Ap-	Construction West to the Character Street
Mississippi. W89-02476 6B	proach for Quantitative Interpretation of Isotope Data under Time Variant Flow Conditions,	Groundwater Withdrawals and Changes in Groundwater Quality and Land Surface Subsid-
Complete Plans in the Namic Conditions in	W89-03017 7C	ence in the Houston District, Texas,
Groundwater Flow in the Navajo Sandstone in Parts of Emery, Grand, Carbon, Wayne, Gar-	Groundwater Flow System in Northern Missou-	W89-02519 6G
field, and Kane Counties, Southeast Utah,	ri with Emphasis on the Cambrian-Ordovician	Hydrology and Water Quality at the Weldon
W89-02521 2F	Aquifer,	Spring Radioactive Waste-Disposal Sites, St.
Geohydrology and Susceptibility of Major	W89-03023 2F	Charles County, Missouri, W89-02528 5B
Aquifers to Surface Contamination in Alabama;	Groundwater Flow through a Miliolite Lime-	W 07-02320
Area 8, W89-02564 5B	stone Aquifer,	Selected Water-Quality Data for the Murtaugh
	W89-03050 2F	Lake Area, South Central Idaho, June 1987, W89-02530 7C
Geohydrology and Susceptibility of Coldwater	Groundwater Occurrence and Flow Pattern in	
Spring and Jacksonville Fault Areas to Surface Contamination in Calhoun County, Alabama,	the Enugu Coal-Mine Area, Anambra State, Ni-	Water Quality of Runoff to the Clarksville Me- morial Hospital Drainage Well and of Mobley
W89-02576 5B	geria, W89-03051 2F	Spring, Clarksville, Tennessee, February-March
Geohydrology and Susceptibility of Major		1988,
Aquifers to Surface Contamination in Alabama,	Vulnerability Study of the Aubergenville Aqui-	W89-02556 5B
Area 7,	fer, W89-03077 5B	Quality of Groundwater in Shallow Wells in
W89-02577 5B		Agricultural Areas of Haywood, Shelby, Lake,
Geohydrology and Susceptibility of Major	Modeling Groundwater Transport of Dissolved Gasoline and Using the Results to Evaluate Aq-	and Obion Counties, Tennessee, January-Febru- ary 1988,
Aquifers to Surface Contamination in Alabama,	uifer Restoration Processes,	W89-02557 5B
Area 1, W89-02578 5B	W89-03321 5B	Carladada and Carantellian of Main
	GROUNDWATER POLLUTION	Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama;
Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama,	Dry Wells - Solution or Pollution: An Arizona	Area 9,
Area 6,	Status Report,	W89-02563 5B
W89-02590 5B	W89-02338 5B	Geohydrology and Susceptibility of Major
Analytically-Derived Sensitivities in One-Di-	Random Survey of VOC's, Pesticides and Inor-	Aquifers to Surface Contamination in Alabama;
mensional Models of Solute Transport in Porous	ganics in Arizona's Drinking Water Wells,	Area 8, W89-02564 5B
Media, W89-02595 5B	W89-02344 5A	W 89-02364 3B
W 69-02393	Field Simulation of Waste Impoundment Seep-	Geohydrology and Susceptibility of Coldwater
Stable Isotopes: An Investigation into Their Ap-	age in the Vadose Zone, W89-02348 5B	Spring and Jacksonville Fault Areas to Surface Contamination in Calhoun County, Alabama,
plication in Karst Hydrology in the U.K., with Special Reference to the Malham Area, North	W 07-02348	W89-02576 5B
Yorkshire,	Recognizing Petroleum Hydrocarbon Contami-	Cashadadan and Susantibility of Major
W89-02734 2F	nation in the Vadose Zone with Photoionization Detection Scanning of Field Samples,	Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama,
Groundwater Flow in the Lowland Limestone	W89-02351 5A	Area 7,
Aquifer of Eastern Co. Galway and Eastern Co.	In-Situ Hydrocarbon Extraction, A Case Study,	W89-02577 5B
Mayo, Western Ireland, W89-02736 2F	W89-02354 SG	Geohydrology and Susceptibility of Major
		Aquifers to Surface Contamination in Alabama,
Isotopic Investigation on the Evolution of Groundwater Dynamics in the Principal	Permeable Barriers: A New Alternative for Treatment of Contaminated Ground Waters,	Area 1, W89-02578 5B
Aquifers in the Southern Dobrudja,	W89-02355 5G	
W89-02853 2F	Use of Well Packers To Control TCE and PCE	Groundwater Protection by Accelerated Testing
Configuration and Hydrology of the Pre-Creta-	Contaminants,	of Organic Chemical Breakthroughs of Soil Bar- riers,
ceous Rocks Underlying the Southeastern Coast-	W89-02356 5G	W89-02585 5A
al Plain Aquifer System,	Design and Construction of a Subsurface Gaso-	Water System Responses to Toxic Contamina-
W89-03007 2F	line Recovery System Westminster, Colorado,	tion of Groundwater Supplies,
Mathematical Models for Interpretation of	W89-02357 5G	W89-02586 5F
Tracer Data in Groundwater Hydrology. W89-03009 2F	Advantages of Suction Lift Hydrocarbon Re-	Geohydrology and Susceptibility of Major
	covery Systems: Application At Three Hydro-	Aquifers to Surface Contamination in Alabama,
Role of Tracer Methods in Hydrology as a Source of Physical Information: Basic Concepts	geologic Environments in California, W89-02358 5G	Area 6, W89-02590 5B
and Definitions, Time Relationship in Dynamic	W 03-02330 3G	
Systems,	In Situ Aquifer Denitrification: Remediation of	Reactions and Transport of Trace Metals in
W89-03010 7B	Ammonia and Nitrate Contaminated Subsurface Environments,	Groundwater, W89-02644 5B
General Review of Methodologies and Ap-	W89-02359 5G	
proaches in Mathematical Models for Interpreta- tion of Tracer Data in Hydrology,	Modeling Acid Migration Through Soils,	National Survey of Pesticides in Drinking Water Wells.
W89-03011 2F	W89-02361 5B	W89-02656 5B

GROUNDWATER POLLUTION

Ground Water Contamination from Saltwate		
Intrusion And Limitations on Agricultural Ac	by Subsurface Materials and Clays, W89-03040 55	Methods for Hydrologic Monitoring of Surface
tivities, W89-02662 5		Mining in the Central-Western United States, W89-02490 7A
	Investigations on Leaching of Dicyandiamid	e
Nitrates and Pesticides in Ground Water: A		Accords of Wells and Chemical Pharyses of
Analysis of a Computer-Based Literatur Search,	 suchungen zur Auswaschung von Dicyandiami und Dessen Abbau in Überstauten Boden), 	Ordana water in France and Fryde Countries Count
W89-02666 5		Dakota, W89-02505 2F
	d December of Matelantish ICD ADS in Com	
Impacts of Agricultural Chemicals on Groun Water Quality in Iowa,	d Determination of Metals with ICP-AES in Comparison to the AAS, Photometry, and Milliva	Relation of water Chemistry of the Edwards
W89-02668 5		Aquiter to Hydrogeology and Land Ose, San
	mit der ICP-AES im Vergleich zur AAS, Pho	
Assessment of Empirical Methodologies for Pro	tomette and i monet i min a many	
dicting Ground Water Pollution from Agricu tural Chemicals,	W89-03048 5.	Data on Groundwater Quality for the McDer-
W89-02670 5	B Groundwater Microbiology: Problems and Bio	mitt One Degree X Two Degree Quadrangle,
	logical Treatment: State-of-the-Art Report,	Northern Nevada,
Investigation of Nitrate Contamination in Sha		F W89-02537 7C
low Ground Waters Near Woodward, Oklahema,	Atmospheric, Geological, Marine, and Anthro	Data on Groundwater Quality for the Lovelock
W89-02671 5		One Degree X Two Degree Quadrangle, West-
N. d. 1.1	land,	ern Nevada,
National Assessment of Ground Water Contam nation from Pesticides and Fertilizers,	¹⁻ W89-03076 5	B W89-02538 7C
	B Vulnerability Study of the Aubergenville Aqu	i- Data on Groundwater Quality for the Winne-
	fer.	mucca One Degree X Two Degree Quadrangle,
Quantitative Studies of Biodegradation of Petro		B Central Nevada,
leum And Some Model Hydrocarbons Ground Water and Sediment Environments,		W89-02539 7C
	Movement and Survival of Bacteria in Poro B Media.	Data on Groundwater Quality for the Reno One
	W89-03080	B Degree X Two Degree Quadrangle, Western
Incentives and Institutions to Reduce Pesticio	le	Nevada,
Contamination of Ground Water, W89-02677 5	Biological Degradation of Volatile Chlorinate	ed W89-02540 7C
W 65-02011	Trydrocarbons in Groundwater,	B Data on Groundwater Quality for the Walker
Poultry Manure Management and Groun	d #85-03081	 Data on Groundwater Quality for the Walker Lake One Degree X Two Degree Quadrangle,
Water Quality: The Delaware Solution, W89-02678	Potential of Free-Living Ground Water Bacter	Western Nevada and Eastern California.
W89-02078	to Degrade Aromatic Trydrocaroons and Trea	r- W89-02541 7C
Nitrogen and Ground Water Protection.	ocyclic Compounds, W89-03086	B Date on Groundwater Quality for the Tononeh
W89-02679 5	G W89-03080	Data on Groundwater Quality for the Tonopah One Degree X Two Degree Quadrangle, Cen-
Developing a State Ground Water Policy in the	Biological Groundwater Denitrification: Lab	o- tral Nevada,
Corn Belt: the Iowa Case,	ratory Studies,	W90 02542
W89-02681	F W89-03096	T .
Superfund Record of Decision: Rockaway Bo	Biodegradation Modeling at Aviation Fuel Sp	ill Data on Groundwater Quality for the Western
ough Well Field, NJ.	Site,	Nevada Part of the Goldfield One Degree X Two Degree Quadrangle,
	D W89-03100	W89-02543 7C
Superfund Record of Decision: Combe F	Contaminated Aquifers are a Forgotten Comp	
North Landfill, NJ.	nent of the Global N2O Budget,	Data on Groundwater Quality for the Caliente
	G W89-03121	One Degree X Two Degree Quadrangle, East-
Control of Walter Control Control	Groundwater Contamination at a Landfill Sit	ern Nevada, ed W89-02544 7C
Control of Volatile Organic Contaminants Groundwater by In-Well Aeration,	on Fractured Carbonate and Shale,	W 89-02344
		5B Data on Groundwater Quality for the Western
		Nevada Part of the Death Valley One Degree X
Superfund Record of Decision: Kane and Lobard, MD.	 Groundwater Contamination by Nitrates a Chlorides Washed out from Phosphorite Ores 	
	the Negev Desert, Israel,	in W89-02545 7C
	W89-03147	Data on Groundwater Quality for the Southern
Groundwater Assessment Modeling Under		Nevada Part of the Kingman One Degree X
Resource Conservation and Recovery Act, W89-02995	Biodegradation of Nitrogen- and Oxygen-Co taining Aromatic Compounds in Groundwa	Two Degree Quadrangie,
1107-02773	from an Oil-Contaminated Aquifer,	W89-02546 70
Results of Experiments Related to Contact		5B Agricultural Impact on Groundwater Quality
Mine-Spoils Water with Coal, West Decker a	Pilot Plant Demonstration of In-situ Biodegra	W90 03640 67
Big Sky Mines, Southeastern Montana, W89-03001	5B tion of 1,1,1-Trichloroethane,	
	W89-03164	Contribution of Toxic Chemicals to Groundwat er for Domestic On-Site Sewage Disposal Sys
Migration of Acidic Groundwater Seepage fr		Anma
Uranium-Tailings Impoundments: 1. Field Stu and Conceptual Hydrogeochemical Model.	dy Characteristics of the Sorption of Chlorothalo and Azinphos-Methyl to a Soil from a Comm	31/00 00504
W89-03037	5B cial Cranberry Bog,	CI-
	W89-03195	5B Managing Farm Nutrients: Tradeoffs for Sur face- and Ground-Water Quality,
Migration of Acidic Groundwater Seepage fr Uranium-Tailings Impoundments: 2. Geoche		W89-02833 50
cal Behavior of Radionuclides in Groundwa		
W89-03038	5B of Organic Chemical Breakthroughs of Soil I	lar- Corrective Measures for Releases to Ground
Migration of Acidio Complete St.	riers,	water from Solid Waste Management Units,
Migration of Acidic Groundwater Seepage fr Uranium-Tailings Impoundments: 3. Simulati		5A W89-02844 56
of the Conceptual Model with Application		to Evaluation of Baseline Conditions at Leas
Seepage Area A,	Groundwater Protection,	Tract C-a, Rio Blanco County, Colorado,
W89-03039	5B W89-03083	5G W89-02974 5

A Markey of Producer and Blok Academic to	GULF OF MEXICO	Tourse of A many March Davis - IX-
Application of Environmental Risk Analysis to		Treatment of Aqueous Metal Bearing Hazardous
Groundwater Protection,	Causes of Wetland Loss in the Coastal Central	Wastes,
W89-03083 5G	Gulf of Mexico. Volume 2: Technical Narrative.	W89-02396 5D
Ground Water: A Living Ecosystem,	W89-02878 4C	How Clean Is Clean. (What Constitutes the
W89-03084 2F	Causes of Wetland Loss in the Coastal Central	Clean Closure of a Hazardous Waste Land Man-
W 69-03064 21	Gulf of Mexico. Volume 3. Appendices.	agement Facility),
ROUNDWATER RECHARGE	W89-02879 4C	W89-02399 5E
Quantity and Quality of Recharge to the Ogal-		11 07-02377
lala Aquifer from Urban Runoff,	GULLY EROSION	Wastewater Characterization and Hazardous
W89-02340 4C	Runoff and Sediment Transport Dynamics in	Waste Survey, Castle AFB, CA,
	Canadian Badland Micro-Catchments,	W89-02704 5D
Field Study of Ephemeral Stream-Aquifer Inter-	W89-02887 2E	
action,		Superfund Record of Decision: Distler Farm,
W89-02349 2F	Sources of Sediment and Channel Changes in	KŸ.
	Small Catchments of Romania's Hilly Regions,	W89-02778 5G
Ephemeral Runoff and Groundwater Recharge,	W89-02896 2J	
W89-02350 2F	I d-Viding Class Development and Cadiment	Potential for Treatment of Hazardous Organic
P	Landsliding, Slope Development and Sediment	Chemicals with Biological Processes,
Recovery of Moisture/Solute Profiles in Re-	Yield in a Temperate Environment: Northeast	W89-02929 5D
claimed Coal-Mine Spoil, Northwest New	Romania, W89-02897 2J	Torisity of Colonted BCD & Commonds to An
Mexico,	W 89-02897	Toxicity of Selected RCRA Compounds to Ac-
W89-02360 2F	Analysis of Sediment Transport by Debris	tivated Sludge Microorganisms,
Hydrogeology of the Butwal-Bhairahwa Area,	Flows in the Jiangjia Gully, Yunnan,	W89-03165 5D
Lumbini Zone, Nepal,	W89-02909 2J	Promising Technologies for the Biological De-
W89-02380 2F	W 87-02707	toxification of Hazardous Waste,
W 87-02380 21	GULLYING	W89-03322 5D
Recharge as Augmentation in the South Platte	Pattern of Wash Erosion Around an Upland	W 67-03322 3D
Basin,	Stream Head,	Stringfellow Leachate Treatment with RBC,
W89-02482 4B	W89-02886 2J	W89-03328 5D
1107-02102		
Ground Water Recharge for Oklahoma: An	GUNNISON RIVER	HAZARDS
Analysis of Past and Future Methodology,	Surface Water Quality Characteristics in the	Magnitude and Frequency of Debris Flows, and
W89-02660 4B	Upper North Fork Gunnison River Basin, Colo-	Areas of Hazard on Mount Shasta, Northern
	rado,	California.
Odour Control by Artificial Groundwater Re-	W89-02593 5B	W89-03029 2J
charge,		
W89-02799 5F	HALAMINES	HEAD LOSS
	Halamine Water Disinfectants,	Use of Remote Gauging to Measure Sewer
Isotopic Investigation on the Evolution of	W89-03285 5F	Invert Elevations and Head Loss,
Groundwater Dynamics in the Principal		W89-03280 5D
Aquifers in the Southern Dobrudja,	HALOGENATED PESTICIDES	
W89-02853 2F	Literature Study on the Feasibility of Microbio-	HEART DISEASE
*** 1995 60 1 60 4 1 99 4 1	logical Decontamination of Polluted Soils,	Sewage Hardness and Mortality from Cancer
Vulnerability Study of the Aubergenville Aqui-	W89-02916 5G	and Cardiovascular Disease,
fer,	D	W89-03309 5D
W89-03077 5B	Extraction, Clean-up and Group Separation	THE AM DELLESSE
Investigation into Mechanisms of Microbial Ef-	Techniques in Organochlorine Trace Analysis,	HEAT PUMPS
fects on Iron and Manganese Transformations in	W89-03068 5A	Clogging Problems in Groundwater Heat Pump
Artificially Recharged Groundwater,	HALOGENS	Systems in Sweden,
W89-03078 4B		W89-03089 2F
W 69-03076 4D	Degradation of Bromoform and Chlorodibromo- methane in a Catalyzed H2-Water System,	HEAVY METALS
GROUNDWATER STORAGE	W89-03311 2K	Differences in Aluminum Mobilization in Spodo-
Hydrogeology of the Butwal-Bhairahwa Area,	W 69-03311 2K	sols in New Hampshire (USA) and in the Neth-
Lumbini Zone, Nepal,	HARDNESS	erlands as a Result of Acid Deposition,
W89-02380 2F	Sewage Hardness and Mortality from Cancer	W89-02309 5B
17 07-02300	and Cardiovascular Disease,	W 89-02309
Water Resources of Walworth County, South	W89-03309 5D	Comparison of Lake Sediments and Ombrotro-
Dakota,	1107-03307	phic Peat Deposits as Long-Term Monitors of
W89-02489 2F	HAZARDOUS MATERIALS	Atmospheric Pollution,
	Treatment of Hazardous Wastes in a Sequencing	W89-02321 5A
GROUNDWATER WITHDRAWAL	Batch Reactor,	
Land Subsidence in the San Joaquin Valley,	W89-02917 5D	Random Survey of VOC's, Pesticides and Inor-
California, as of 1980,		ganics in Arizona's Drinking Water Wells,
W89-03018 6G	Toxicity of Selected RCRA Compounds to Ac-	W89-02344 5A
	tivated Sludge Microorganisms,	
Land Subsidence in the Santa Clara Valley, Cali-	W89-03165 5D	Plating Waste Sludge Metal Recovery,
fornia, as of 1982,	THE PROPERTY OF THE	W89-02395 5D
W89-03019 6G	HAZARDOUS WASTES	m m
CROWTU	Treatment of Process Wastewater from Petro-	Waste Treatment and Recycling of Mixed
GROWTH Effect of Long-Term Exposure to Acid Alumi	chemical Plant Using a Rotating Biological Con-	Wastewater from a Metal Finishing Company
Effect of Long-Term Exposure to Acid, Alumi- num, and Low Calcium on Adult Brook Trout	there it case stary,	W89-02408 5D
(Salvelinus fontinalis): I. Survival, Growth, Fe-		Transport, Bioaccumulation, and Toxicity of
		Metals and Metalloids in Microorganisms under
cundity, and Progeny Survival,	Land Treatment of Nitroguanidine Wastewater, W89-02293 5D	Environmental Stress,
W89-03241 5C	W89-02293 5D	
Effect of Long-Term Exposure to Acid, Alumi-	Combined Fixed Biological Film Media and	W89-02652 5E
num, and Low Calcium on Adult Brook Trout		Processes, Coefficients, and Models for Simulat
(Salvelinus fontinalis): II. Vitellogenesis and Os		ing Toxic Organics and Heavy Metals in Surface
moregulation,	posal,	Waters.
W89-03242 5C		W89-02788 SI
1107-03242		
Growth and Phosphorous Status of Limnetic	Hazardous Waste Research Pertaining to Metal	Separation of Heavy Metals from Effluents by
Phytoplankton and Bacteria,	Finishing,	Flotation,
W89-03244 2F		W89-02803 5I

HEAVY METALS

Heavy Metal Removal from Sewage Sludge: Practical Experiences with Acid Treatment,	Historical Basis for Limits on Lake Superior Water Level Regulations, W89-03173 4A	Valves in Reservoir Outlets, W89-03072 8C
W89-02818 5D	HONG KONG	Vibration and Leakage of Weir Gates,
Toxicity of Heavy Metals to Thermophilic An-	Assessment of Hydrogeological Features Using	W89-03073 8C
aerobic Digestion, W89-02922 5D	the Technique of Terrain Classification,	HYDRAULIC EQUIPMENT
W 05-02522	W89-02372 7B	Rubber Seals for Steel Hydraulic Gates,
Bacterial Leaching of Heavy Metals from An-		W89-03074 8G
aerobically Digested Sludge,	HOSPITALS	
W89-02925 5D	Concentration of Mycobacterium avium by Hos- pital Hot Water Systems,	HYDRAULIC GATES
Determination of Metals with ICP-AES in Com-	W89-03304 5B	Rubber Seals for Steel Hydraulic Gates,
parison to the AAS, Photometry, and Millival-		W89-03074 8G
Balance of the Anions (Die Metallbestimmung	HOWARD A. HANSON RESERVOIR	HYDRAULIC MACHINERY
mit der ICP-AES im Vergleich zur AAS, Pho-	Temperature Analysis, Howard A. Hanson Res-	Upgrading Hydro Turbines: An Operating
tometrie und Anionen-Millival-Bilanz),	ervoir, Washington: Mathematical Model Inves- tigation,	Authority's Experience,
W89-03048 5A	W89-02877 2H	W89-03152 8C
Recent Acidification of a Large Scottish Loch		New Lebring Scheme Replaces the Oldest Plant
Located Partly within a National Nature Re-	HUDSON BAY	on the Mur,
serve and Site of Special Scientific Interest,	Influence of a River Plume on the Sea-ice Meio-	W89-03153 8C
W89-03125 5C	fauna in South-eastern Hudson Bay, W89-03189 2L	
Distribution of Contaminants in Clams and Sedi-	W 69-03169	Rehabilitation of the Kuratau Station in New
ments from the Huron-Erie Corridor: II. Lead	HUMAN DISEASES	Zealand,
and Cadmium,	Temporal Relationship of Vibrio parahaemolyti-	W89-03154 8C
W89-03177 5B	cus in Patients and the Environment,	Updating and Refurbishing Hydro Plants in
Ultra-Trace-Level Determination of Cobalt,	W89-03064 5B	India,
Chromium, and Hydrogen Peroxide by Luminol	Schistosomiasis Control in Irrigation Schemes in	W89-03155 8C
Chemiluminescence Detected With a Charge-	Zimbabwe,	
Coupled Device,	W89-03066 5G	Extending the Operating Life of Hydro Equip-
W89-03181 7B	HUMAN PATHOLOGY	ment, W89-03156 8C
A To lake of Pierro Mineral of Fig. Co	Appendicitis Epidemic Following Introduction	W 65-03130
Acute Toxicity of Binary Mixtures of Five Cations (Cu(2+), Cd(2+), Zn(2+), Mg(2+), and	of Piped Water to Anglesey,	Uprating of Four Indian Hydro Plants,
K(+)) to the Freshwater Amphipod Gammarus	W89-03041 5F	W89-03157 8C
lacustris (Sars): Alternative Descriptive Models,	Part Cata Table 1 Committee of	INDBALL IC MODELS
W89-03212 5C	Problems of the Toxicological Compatibility of Hydrogen Peroxide in Drinking and Swimming	Plaunttaum Basch Analoshicala Biuer Maus
	Pool Water for Humans from the Pharmacokine-	Blountstown Reach, Apalachicola River, Mova- ble-Bed Model Study,
Growth, Fecundity, and Energy Stores of White Sucker (Catostomus commersoni) from Lakes	tic and Biochemical Points of View (Probleme	W89-02416 2J
Containing Elevated Levels of Copper and Zinc,	Der Humantoxikologischen Vertraglichkeit von	
W89-03225 5C	Wasserstoffperoxid in Bade- and Trinkwasser	Jefferson Barracks Bridge, Movable-Bed Model
	aus Biochemischer und Pharmakokinetischer	Study,
Mass Balance of Heavy Metals in the Seto	Sicht), W89-03042 5C	W89-02417 2J
Inland Sea, Japan, W89-03278 5B	W 89-03042	Martins Fork Lake Sedimentation Study: Hy-
W89-03278 5B	HUMAN PHYSIOLOGY	draulic Model Investigation,
HERBICIDES	Gastrointestinal Absorption of Soluble Uranium	W89-02780 2J
Effect of Temperature on the Chronic Toxicity	from Drinking Water,	Mathematical Hudowlin Madal of the Diver-
of Hydrothol-191 to the Fathead Minnow (Pi-	W89-02957 5B	Mathematical Hydraulic Model of the River Nene a Canalized, and Heavily Controlled
mephales promelas),	HUMIC COMPOUNDS	River.
W89-03206 5C	Role of Phenolic and Humic Compounds in	W89-03141 4A
Impairment of Mobility and Development in	Anaerobic Digestion Processes,	
Freshwater Snails (Physa fontinalis and Lym-	W89-02924 5D	HYDRAULIC ROUGHNESS
naea stagnalis) Caused By Herbicides,	HUMIC SUBSTANCES	Roughness Coefficients for Densely Vegetated
W89-03290 5C	Microbial Activity in Sanitary Landfills: A Pos-	Flood Plains, W89-02502 2E
Evaluation of the Acute Toxicity to Juvenile	sible Source of the Humic Substances in	W 67-02302 2E
Pacific Salmonids of Hexazinone and its Formu-	Groundwater,	HYDRAULIC STRUCTURES
lated Products: Pronone 10G, Velpar L, and	W89-03079 5B	Review of the State of the Art for Underwater
Their Carriers,	HURRICANES	Repair Using Abrasion-Resistant Concrete.
W89-03316 5C	Hurricane-Induced Sediment Deposition in a	W89-02781 8F
HIGH PERFORMANCE LIQUID	Gulf Coast Marsh,	Load-Sharing Linings: A New Design Concept
CHROMATOGRAPHY	W89-03193 2J	for Large Diameter Penstocks,
Application of XAD-4 Solid Sorbent and HPLC	HYDRAULIC CONDUCTIVITY	W89-03158 8F
with Electrochemical Detection to the Analysis	Consideration of Dimensional Dependence in	
of Phenois in Water,	Modelling the Structure of Flow Zones within	HYDRAULIC TURBINES
W89-02420 5A	the Subsurface,	Developments in the Design of Bulb Turbines, W89-03069 8C
HISTORY	W89-02551 5B	# 03-03009 8C
Great American Desert Transformed: Aridity,	HYDRAULIC DESIGN	Calculation of Prototype Cavitation Characteris-
Exploitation, and Imperialism in the Making of	Design of Reinforced Grass Waterways,	tics in Large Bulb Turbines,
the Modern American West,	W89-02859 8A	W89-03070 8C
W89-02632 6D	HVDD ALIT IC ENCINEEDING	Uprating the Laufenburg Swiss/German Power
Water Management Issues in the Denver, Colo-	HYDRAULIC ENGINEERING Developments in the Design of Bulb Turbines,	Station with Ten Straflo Units,
rado, Urban Area,	W89-03069 8C	W89-03071 8C
W89-02638 6D		
Natural History of Lakes	Calculation of Prototype Cavitation Characteris-	HYDRAULIC VALVES
Natural History of Lakes, W89-02775 2H	tics in Large Bulb Turbines, W89-03070 8C	Valves in Reservoir Outlets, W89-03072

HYDRAULICS Peak/Risk/Culvert: A Program to Compute	Upgrading Hydro Turbines: An Operating Authority's Experience, W89-03152 8C	Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout
Peak Flows, Hydrologic Risk, and Circular Culvert Sizes at Forest Road Crossings,	New Lebring Scheme Replaces the Oldest Plant	(Salvelinus fontinalis): I. Survival, Growth, Fe- cundity, and Progeny Survival,
W89-02831 2E	on the Mur, W89-03153 8C	W89-03241 5C
HYDROBIOLOGY Ecological Research on South African Rivers -	Rehabilitation of the Kuratau Station in New	Morphometric Changes in Gill Secondary La- mellae of Brook Trout (Salvelinus fontinalis)
A Preliminary Synthesis, W89-02982 2H	Zealand, W89-03154 8C	after Long-Term Exposure to Acid and Alumi- num,
HYDROCARBONS		W89-03243 5C
Recognizing Petroleum Hydrocarbon Contami- nation in the Vadose Zone with Photoionization Detection Scanning of Field Samples,	Extending the Operating Life of Hydro Equipment, W89-03156 8C	Effect of pH on Iron and Manganese Uptake by a Green Alga, W89-03246 5C
W89-02351 5A	Uprating of Four Indian Hydro Plants,	HYDROGEN SULFIDE
In-Situ Hydrocarbon Extraction, A Case Study, W89-02354 5G	W89-03157 8C	Hydrogen Sulphide Control in Municipal
Advantages of Suction Lift Hydrocarbon Re-	HYDROELECTRIC POWER Hydrologic Design Methodologies for Prefeasi-	Sewers, W89-02810 5D
covery Systems: Application At Three Hydro-	bility Studies of Small-Scale Hydro at Ungauged Sites,	HYDROGEOLOGY
geologic Environments in California, W89-02358 5G	W89-03129 7A	Hydrogeological Mapping in Asia and the Pacif- ic Region.
Literature Study on the Feasibility of Microbio-	Effects of Hydroelectric Scheme on Fluvial Ecosystems within the Spanish Pyrenees,	W89-02364 7B
logical Decontamination of Polluted Soils, W89-02916 5G	W89-03138 6G	Assessment and Mapping of Australia's Ground- water Resources,
Potential of Free-Living Ground Water Bacteria	HYDROELECTRIC POWERPLANTS Effects of Aeration and Minimum Flow En-	W89-02365 2F
to Degrade Aromatic Hydrocarbons and Heter- ocyclic Compounds,	hancement on the Biota of Norris Tailwater, W89-02826 5G	Hydrogeological Mapping in Fiji, W89-02366 2F
W89-03086 5B	HYDROGEN	Position Paper: Solomon Islands,
Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale,	Hydrogen (H2) Distributions in the Carmans River Estuary,	W89-02367 2F
W89-03301 5A	W89-03194 2L	Hydrogeological Development in Vanuatu, W89-02368 2F
HYDRODYNAMICS Hydrodynamics of Estuaries, Volume I: Estua-	HYDROGEN ION CONCENTRATION Proton Cycling in Bogs: Geographical Variation	Water-Bearing Zones in the Mining Area of the
rine Physics. W89-02682 2L	in Northeastern North America, W89-02316 5B	Northern Region of Bangladesh with Regard to Utilization of Mine Water for Irrigation and Other Uses,
Dynamics of Partially Mixed Estuaries, W89-02683 2L	Results of Intercomparison Studies for the Meas- urements of pH and Specific Conductance at National Atmospheric Deposition Program/Na-	W89-02369 2F Development and Achievements of Hydrogeo-
Dynamic Control by Topography in Estuaries, W89-02684 2L	tional Trends Network Monitoring Sites, Octo- ber 1981-October 1985,	logical Mapping in China, W89-02370 2F
Tidal Dynamics of Estuaries,	W89-02485 5A	Groundwater in China,
W89-02687 2L	Summary of Maryland Stream pH and Alkalinity Data: Analysis of Its Application to Assessing	W89-02371 2F
Eulerian and Lagrangian Modeling of Estuarine Hydrodynamics, W89-02691 2L	the Impacts of Acidic Deposition, W89-02840 5C	Assessment of Hydrogeological Features Using the Technique of Terrain Classification, W89-02372 7B
	Effect of pH on Speciation and Toxicity of	
Hydrodynamics of Estuaries, Volume II: Estua- rine Case Studies. W89-02692 2L	Aluminum to Rainbow Trout (Salmo gairdneri), W89-03213 5C	Groundwater Resources Development and Man- agement in India, W89-02373 2F
Consequences of Dredging,	Long-Term Sublethal Acid Exposure in Rain- bow Trout (Salmo gairdneri) in Soft Water:	Hydrogeological Problems of Hard Rock Areas
W89-02700 2L	Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C	of Southern India, W89-02374 2F
Vulnerability Study of the Aubergenville Aqui- fer,	Scaled Chrysophytes (Chrysophyceae) as Indi-	Status of Hydrogeological Mapping in Indonesia
W89-03077 5B	cators of pH in Sudbury, Ontario, Lakes,	in 1983,
HYDROELECTRIC MACHINERY	W89-03227 5A	W89-02375 7B
Updating and Refurbishing Hydro Plants in India,	Effects of Aluminum and Low pH on Net Ion Fluxes and Ion Balance in the Brook Trout	Status of Hydrogeological Mapping in Peninsu- lar Malaysia,
W89-03155 8C	(Salvelinus fontinalis), W89-03235 5C	W89-02377 2F
HYDROELECTRIC PLANTS		Notes on the Hydrogeological Map of Sarawak,
Design Problems in Gravel-Bed Rivers, Alaska, W89-02458 2J	Physiological Evidence of Acclimation to Acid/ Aluminum Stress in Adult Brook Trout (Salve- linus fontinalis): I. Blood Composition and Net	W89-02378 2F Water Resources and Hydrogeological Mapping
Cumulative Impact Assessment: Application of a	Sodium Fluxes,	in the Mongolian People's Republic,
Methodology, W89-02824 7C	W89-03237 5C	W89-02379 2F
Cumulative Impact Assessment: Issues to Con-	Physiological Evidence of Acclimation to Acid/ Aluminum Stress in Adult Brook Trout (Salve-	Hydrogeology of the Butwal-Bhairahwa Area, Lumbini Zone, Nepal,
sider in Selecting a Cumulative Assessment Method,	linus fontinalis): II. Blood Parameters by Cannulation.	W89-02380 2F
W89-02965 5C	W89-03238 5C	Pakistan-Status Report,
Uprating the Laufenburg Swiss/German Power	Effects of Low pH and Aluminum on Ventila-	W89-02381 4B
Station with Ten Straflo Units, W89-03071 8C	tion in the Brook Trout (Salvelinus fontinalis), W89-03240 5C	Hydrogeological Mapping in the Philippines, W89-02382 2F

HYDROGEOLOGY

Development of Groundwater Resources in Sri	Water Resources of Walworth County, South	Assessment and Mapping of Australia's Ground-
Lanka, W89-02383 4B	Dakota, W89-02489 2F	water Resources, W89-02365 2F
Status of Hydrogeological Mapping in Thailand, W89-02384 2F	Groundwater Resources of Rusk County, Texas, W89-02491 2F	Hydrogeological Mapping in Fiji, W89-02366 2F
International Legend for Hydrogeological Maps: Principles and Application, W89-02386 7B	Groundwater Data for Michigan-1986, W89-02495 7C	Position Paper: Solomon Islands, W89-02367 2F
Data Requirements for Hydrogeological Maps, W89-02387 7A	Hydrology of Area 31, Eastern Region, Interior Coal Province, Illinois and Indiana,	Hydrogeological Development in Vanuatu, W89-02368 2F
	W89-02508 5B	Development and Achievements of Hydrogeolo-
Organization of Hydrogeological Mapping Programs, W89-02388 7B	Construction, Geologic, and Hydrologic Data for Observation Wells in the Reelfoot Lake Area, Tennessee and Kentucky,	gical Mapping in China, W89-02370 2F
Report on Hydrogeological Maps of Karstic	W89-02510 7B	Groundwater in China,
Terrains, W89-02389 2F	Groundwater Levels in Wyoming, 1976	W89-02371 2F
	Through 1985, W89-02525 7C	Groundwater Resources Development and Man- agement in India,
Hydrogeological Mapping in Coastal Areas, W89-02390 2F		W89-02373 2F
	Selected Hydrogeologic Data for the Southwest Glendive Preliminary Logical Mining Unit and	Hydrogeological Problems of Hard Rock Areas
Hydrogeological Maps from the View-Point of the User,	Adjacent Areas, Dawson County, Montana,	of Southern India,
W89-02391 7A	W89-02531 7C	W89-02374 2F
Potentiometric Surface of the Intermediate Aq-	Water Resources Investigations in Tennessee:	Status of Hydrogeological Mapping in Indonesia
uifer System, West-Central Florida, September 1986,	Programs and Activities of the U.S. Geological Survey, 1987-1988,	in 1983, W89-02375 7B
W89-02532 7C	W89-02559 7C	Status of Hydrogeological Mapping in Peninsu-
HYDROGRAPH ANALYSIS	Hydrologic Reconnaissance of the Chilkat River	lar Malaysia,
Techniques for Estimating Regional Flood Characteristics of Small Rural Watersheds in the	Basin, Southeast Alaska (with Special Reference to the Bald Eagle Critical Habitat at the Tsirku	W89-02377 2F
Plains Region of Eastern Colorado, W89-02507 2E	River Alluvial Fan),	Notes on the Hydrogeological Map of Sarawak, W89-02378 2F
	W89-02565 2E	
HYDROGRAPHS Groundwater Levels in Wyoming, 1978	Water Resources Activities of the U.S. Geologi- cal Survey in Missouri, Fiscal Year 1987.	Water Resources and Hydrogeological Mapping in the Mongolian People's Republic,
Through September 1987, W89-02468 4B	W89-02567 9C	W89-02379 2F
Groundwater Levels in Wyoming, 1976	Water Resources Investigations in Tennessee:	International Legend for Hydrogeological
Through 1985,	Programs and Activities of the U.S. Geological Survey, 1987-1988,	Maps: Principles and Application, W89-02386 7B
W89-02525 7C	W89-02570 9C	HYDROLOGIC MODELS
Map Showing Groundwater Levels in Anchor- age, Alaska, 1985,	Water Resources Activities of the U. S. Geologi-	Comparison of Conceptually Based and Regres-
w89-02526 7C	cal Survey in Texas - Fiscal Year 1987, W89-02574 9C	sion Rainfall-Runoff Models, Denver Metropoli- tan Area, Colorado, and Potential Applications
Simulation of Flood Hydrographs for Georgia	January 1987 Water Levels, and Data Related to	in Urban Areas, W89-02483 4C
Streams, W89-03002 5E	Water Level Changes, Western and South-Cen-	
HYDROGRAPHY	tral Kansas, W89-02594 2F	Interactive Simulation of Chemical Movement in Soil,
Groundwater in China,		W89-02675 5B
W89-02371 2F	Seasonal Changes in Groundwater Levels in the Shallow Aquifers Near Hagerman and the Pecos	Application of a Transport-Diffusion Model to a
Groundwater Resources Development and Man-	River, Chaves County, New Mexico,	Coastal Aquifer Utilizing In situ Measurements
agement in India, W89-02373 2F	W89-02601 4B	of Dispersivity, W89-03016 2F
	Annual Yield and Selected Hydrologic Data for	
Hydrogeological Problems of Hard Rock Areas of Southern India, W89-02374 2F	the Arkansas River Basin Compact, Arkansas- Oklahoma, 1987 Water Year, W89-02602 2E	Modeling of Total Nitrogen in River Using the Quantity-Quality Model CEQUEAU (Modelisa- tion de l'Azote Total en Riviere a l'Aide du
Review of Groundwater in the Republic of		Modele Quantite-Qualite CEQUEAU),
Korea,	Geophysical Logs and Hydrological Data for Eight Wells in the Coyote Spring Valley Area,	W89-03130 5B
W89-02376 2F	Clark and Lincoln Counties, Nevada,	HYDROLOGIC STUDIES
Laguna Madre of Texas: Hydrography of a Hy- persaline Lagoon,	W89-02603 4B	Hydrology 2000. W89-02717 2A
W89-02695 2L	Water Quality Data for Orwell Reservoir and the Otter Tail River Near Fergus Falls, Minne-	Surface Water Hydrology,
Plankton,	sota,	W89-02719 2E
W89-02770 2L	W89-02605 5B	HYDROLOGIC SYSTEMS
HYDROLOGIC BUDGET	HYDROLOGIC DATA COLLECTION	Identification of a Karst Hydrological System in
Hydrologic Analysis of the Rio Grande Basin North of Embudo, New Mexico, Colorado and	Surface Water Quality Characteristics in the Upper North Fork Gunnison River Basin, Colo-	the Dinaric Karst (Yugoslavia), W89-03052 2F
New Mexico,	rado,	
W89-02589 2F	W89-02593 5B	Hydrology in Practice,
HYDROLOGIC DATA	HYDROLOGIC MAPS	W89-02421 2A
Water Resources Activities of the U.S. Geologi- cal Survey in Missouri, Fiscal Year 1987.	Hydrogeological Mapping in Asia and the Pacif- ic Region.	Hydrological Sciences in Perspective,
W89-02470 9C	W89-02364 7B	W89-02718 2A

Hydrology versus Water Resources Management, W89-02724 2A	Intensive Survey of the DuPage River Basin, 1983. W89-02829 5G	INDUSTRIAL WASTES Pretreatment of Wastewater from the Automobile Industry,
Hydrology and Data Acquisition,	Intensive Survey of the Fox River Basin from	W89-02804 5D
W89-02726 2A	the Wisconsin State Line to Ottawa, Illinois:	Waste Minimization Audit Report: Case Studies of Minimization of Mercury-Bearing Wastes at a
Hydrology and Hydrologists, W89-02727 2A	W89-02841 5G	Mercury Cell Chloralkali Plant, W89-02821 5E
Hydrologic Design Methodologies for Prefeasi- bility Studies of Small-Scale Hydro at Ungauged Sites,	Intensive Survey of the Kishwaukee River and its Tributaries, 1983. W89-02858 5C	U.S. Production of Manufactured Gases: Assessment of Past Disposal Practices,
W89-03129 7A	Volunteer Lake Monitoring Program, 1987.	W89-02964 5E
Hydrochory and Regeneration in a Bald Cy- press-Water Tupelo Swamp Forest,	Volume I: Statewide Summary Report, W89-02869 7B	Groundwater Assessment Modeling Under the Resource Conservation and Recovery Act, W89-02995 5B
W89-03295 2H	Preliminary Environmental Assessment of the Contamination Associated with Lake Calumet,	Biological Degradation of Volatile Chlorinated
HYDROTHERMAL STUDIES Reconnaissance of the Hydrothermal Resources of Utah.	Cook County, Illinois, W89-02870 5B	Hydrocarbons in Groundwater, W89-03081 5B
W89-03020 2F	Definite Project Report for Section 14. Emer-	Thermophilic Anaerobic Digestion of Winery
HYPERSALINITY	gency Streambank Protection, Sangamon River	Waste (Vinasses): Kinetics and Process Optimi-
Laguna Madre of Texas: Hydrography of a Hy- persaline Lagoon,	Sewage Treatment Facility, Riverton, Illinois. W89-02934 4D	zation, W89-03114 5D
W89-02695 2L	Estimating Generalized Skew of the Log-Pear-	Review of Environmental Toxicity of Quater-
HYPORHEIC ZONE Hyporheic Habitat of River Ecosystems,	son Type III Distribution for Annual Peak Floods in Illinois,	nary Ammonium Halides, W89-03298 5C
W89-03122 2E	W89-03006 2E	INDUSTRIAL WASTEWATER
ICE	IN SITU EXTRACTION	Process Development and Treatment Plant
Snow and Ice, W89-02722 2C	In-Situ Hydrocarbon Extraction, A Case Study, W89-02354 5G	Startup for an Explosives Industry Wastewater, W89-02287 5D
Diagnostic Technique for Targeting during Airborne Seeding Experiments in Wintertime Storms over the Sierra Nevada, W89-03305	INCINERATION Chemical Treatment of Flue Gas Washing Liquids,	Anaerobic Digestion of Chemical Industry Wastewaters Containing Toxic Compounds by Downflow Fixed Film Technology. W89-02291 5D
	W89-02809 5D	
ICE COVER Snow Cover, Cyclogenesis and Cyclone Trajec-	Municipal Wastewater Sludge Combustion Technology.	Performance of Analytical Test Kits on Metal Finishing Wastewater Samples, W89-02403 5D
tories, W89-02607 2C	W89-02872 5D	W89-02403 5D
Northern Hemisphere Snow and Ice Chart of	INDIA Groundwater Resources Development and Man-	Pretreatment in Chemical Water and Wastewater Treatment.
NOAA/NESDIS, W89-02616 2C	agement in India, W89-02373 2F	W89-02791 50 Pretreatment of Industrial Wastewater: Lega
ICE-WATER INTERFACES Influence of a River Plume on the Sea-ice Meio-	Hydrogeological Problems of Hard Rock Areas of Southern India,	and Planning Aspects-A Case Study, W89-02800 5I
fauna in South-eastern Hudson Bay, W89-03189 2L	W89-02374 2F	Industrial Wastewater Pretreatment of a Dental
ICED LAKES Operations for an Under-Ice Ecology Program,	Eurasian Snow Cover and Seasonal Forecast of Indian Summer Monsoon Rainfall,	Pharmaceutical Company, W89-02805 5E
W89-03179 2H	W89-03054 2B	Membrane Separation Processes for Industria
IDAHO	Engineering, Mosquitoes and Filariasis: A Case Report.	Effluent Treatment, W89-02806 5I
Water Quality Data for the Boise River, Boise to Star, Idaho, October to December 1987,	W89-03065 5G	Aerobic Treatment of Sewage from Lignit
W89-02464 5C	Updating and Refurbishing Hydro Plants in India,	(Brown Coal) Processing, W89-02915 5I
Review of Groundwater in the Republic of	W89-03155 8C	Anacionic Degradation of Thenone Compound
Korea, W89-02376 2F	Uprating of Four Indian Hydro Plants, W89-03157 8C	with Applications to Treatment of Industria Waste Waters, W89-02918
II.LINOIS Hydrology of Area 27, Eastern Region, Interior	INDIAN TRIBES	Biological Treatment of Toxic Industrial Waste
Coal Province, Illinois, W89-02484 5B	Implications of the Clean Water Act and Safe Drinking Water Act Legislation for Southwest- ern Indian Tribes: Water-Quality Management	W89-02919 51
Assessment of Water Quality and Factors Affecting Dissolved Oxygen in the Sangamon	and Indian Self Determination, W89-02334 5G	Wastes,
River, Decatur to Riverton, Illinois, Summer		
1982, W89-02486 5B	INDIANA Agricultural Impact on Groundwater Quality, W89-02549 5B	
Hydrology of Area 31, Eastern Region, Interior		
Coal Province, Illinois and Indiana, W89-02508 5B	INDONESIA Status of Hydrogeological Mapping in Indonesia in 1983,	Anaerobic Treatment of Sulfate-Containin Waste Water, W89-02930 51
Data-Collection Methods and Data Summary	W89-02375 7B	
for the Assessment of Water Quality in Cedar Creek, West-Central Illinois,	Vibration and Leakage of Weir Gates,	Superfund Record of Decision: Northern Engraving, WI.
W89-02520 7B	W89-03073 8C	W89-02938 5

INDUSTRIAL WASTEWATER

Evaluation of Biological Treatment of Pharma- ceutical Wastewater with PAC Addition. Volume I.	In Situ Biological Groundwater Denitrification: Concepts and Preliminary Field Tests, W89-03097 5G	for Sunflower AAP NQ Wastewater Treatment Facility, W89-02828 5D
W89-02948 5D		IONS
Water Quality Assessment of DOD Installa- tiona/Facilities in the Chesapeake Bay Region. Phase III Report. Volume 1 - Summary. W89-02935	Sediment Transport Prediction in a Tidal Inlet Using a Numerical Model: Application to Stony Brook Harbor, Long Island, New York, USA, W89-03185 2J	Relations of Specific Conductance to Stream- flow and Selected Water Quality Characteristics of the Arkansas River Basin, Colorado, W89-02599 2K
Water Quality Assessment of DOD Installa-	INSECTICIDES	IOWA
Waser Quanty Assessment of DOD missian tions/Facilities in the Chesapeake Bay Region. Phase III Report. Volume 2 - Overall Approach, Findings and Recommendations. W89-02954 5C	Acute Toxicity of Malathion, Tetrabromobis- phenol-A, and Tributyltin Chloride to Mysids (Mysidopsis bahia) of Three Ages, W89-03203 5C	Impacts of Agricultural Chemicals on Ground Water Quality in Iowa, W89-02668 5B
		Assessing Some Potentials for Changing Agro-
Development of an Innovative and Cost-Effec- tive Municipal-Industrial Waste Treatment System, W89-02960 5D	Diffubenzuron Application to Citrus and Its Impact on Invertebrates in an Adjacent Pond, W89-03208 5C	nomic Practices and Improving Ground Water Quality: Implications from a 1984 Iowa Survey, W89-02669 5G
	INSTREAM FLOW DEMAND Case Study of Minimum Streamflow for Fishery	Developing a State Ground Water Policy in the
Anaerobic Fluidized Bed Treatment of an Indus- trial Wastewater, W89-03162 5D	Habitat in the Yampa River, W89-02460 2J	Corn Belt: the Iowa Case, W89-02681 2F
	INTAKES	Pesticide and Synthetic Organic Compound
NFECTION Temporal Relationship of Vibrio parahaemolyticus in Patients and the Environment,	Air Demand and Conduit Pressures, Stillhouse Hollow Dam, Lampasas River, Texas, W89-02415 8B	Survey: Report to the Iowa General Assembly on the Results of the Water System Monitoring Required by House File 2303.
W89-03064 5B	INTERNATIONAL LAW	W89-02836 5F
NFILTRATION Field Study of Ephemeral Stream-Aquifer Inter- action,	Historical Basis for Limits on Lake Superior Water Level Regulations,	IRELAND Controls on the Composition of Authigenic Per-
W89-02349 2F	W89-03173 4A	colation Water in the Burren, Ireland, W89-02730 2K
Ephemeral Runoff and Groundwater Recharge, W89-02350 2F	INTERSTATE COMPACTS Annual Yield and Selected Hydrologic Data for the Arkansas River Basin Compact, Arkansas-	Groundwater Flow in the Lowland Limestone Aquifer of Eastern Co. Galway and Eastern Co.
Determination of Evaporation and Seepage Losses, Upper Lake Mary near Flagstaff, Arizo-	Oklahoma, 1987 Water Year, W89-02602 2E	Mayo, Western Ireland, W89-02736 2F
na, W89-02558 2H	INTERSTATE RIVERS	IRON
	Water Resources of the Upper Colorado River	Why Not Simplify Wastewater Compliance, W89-02397 5D
Research and Information Needs,	Basin: Problems and Policy Alternatives, W89-02635 6D	
W89-02993 2H	INTERSTITIAL WATER	Combining Field Measurements for Speciation in Non Perturbable Water Samples: Application
INFORMATION SYSTEMS	Interstitial Water Quality of Lake Trout Spawn-	to the Iron and Sulfide Cycles in a Eutrophic
Development, Management, and Analysis of a Long-Term Ecological Research Information	ing Habitat, W89-03172 5C	Lake, W89-02645 5B
Base: Example for Marine Macrobenthos, W89-02329 10D	Hydrogen (H2) Distributions in the Carmans	Sequestration of Iron in Groundwater by Poly-
INFORMATION TRANSFER	River Estuary, W89-03194 2L	phosphates, W89-03109 5F
Fiscal Year 1986 Program Report (New York	INTERTIDAL AREAS	
Water Resources Institute), W89-02471 9D	Flora and Macrofauna of Intertidal Sediments, W89-02763 2L	Effect of pH on Iron and Manganese Uptake by a Green Alga, W89-03246 5C
Fiscal Year 1986 Program Report (Colorado	Intertidal Rock,	IRRADIATION
Water Resources Research Institute), W89-02477 9D	W89-02767 2L	Photodecomposition of Chlorophenols in Aque- ous Medium in Presence of Hydrogen Peroxide,
Fiscal Year 1986 Program Report (Wyoming	INVERTEBRATES Hyporheic Habitat of River Ecosystems,	W89-03200 5B
Water Research Center), W89-02479 9D	W89-03122 2E	IRRIGATION
	Indirect Effects and Biological Control of Mos-	Water-Bearing Zones in the Mining Area of the
Fiscal Year 1987 Report (Georgia Water Resources Research Institute), W89-02553 9D	quitoes by Mosquitofish, W89-03124 2H	Northern Region of Bangladesh with Regard to Utilization of Mine Water for Irrigation and Other Uses.
Fiscal Year 1987 Program Report (North Caroli-	Diflubenzuron Application to Citrus and Its	W89-02369 2F
na Water Resources Research Institute). W89-02554 9D	Impact on Invertebrates in an Adjacent Pond, W89-03208 5C	Pakistan-Status Report, W89-02381 4B
Fiscal Year 1986 Program Report (Massachu-	Secondary Production and Trophic Relation-	
setts Water Resources Research Center), W89-02587 9D	ships in a Spring Invertebrate Community, W89-03250 2H	Schistosomiasis Control in Irrigation Schemes in Zimbabwe, W89-03066 5G
INFRARED RADIATION	IODINE	
Nimbus-7 Global Cloud Climatology: Part I. Algorithms and Validation,	Iodine Speciation in Chesapeake Bay Waters, W89-03277 2L	Wastewater Irrigation of Vegetable Crops, W89-03282 5E
W89-03307 2B	ION EXCHANGE	Principles of Form Irrigation System Design
INJECTION WELLS	Waste Treatment and Recycling of Mixed Wastewater from a Metal Finishing Company,	Principles of Farm Irrigation System Design, W89-02422 3F
Summary of Well Construction, Testing, and Preliminary Findings from the Alligator Alley	W89-02408 5D	Microcomputer Program Development for On-
Test Well, Broward County, Florida, W89-02465 4B	Economic Evaluation of Carbon Adsorption/ Ion Exchange Wastewater Treatment Options	Farm Irrigation Systems Planning, W89-02550 6A

IRRIGATION PRACTICES Effects of Irrigation Practices on Stream-Connected Phreatic Aquifer Systems,	KANSAS January 1987 Water Levels, and Data Related to Water Level Changes, Western and South-Cen-	Karst Water Temperature and the Shaping of Malham Cove, Yorkshire, W89-02737 2F
W89-02661 3F	tral Kansas, W89-02594 2F	Chemical Erosion in Tower Karst Terrain.
IRRIGATION REQUIREMENTS	-	Kinta Valley, Peninsular Malaysia,
West in Profile, W89-02631 6D	Summary of the High Plains Regional Aquifer- System Analysis in Parts of Colorado, Kansas,	W89-02738 2J
	Nebraska, New Mexico, Oklahoma, South	Hydrological Development of Tropical Tower
ISOTOPE STUDIES Recovery of Moisture/Solute Profiles in Re-	Dakota, Texas, and Wyoming, W89-03030 2F	Karst: An Example from Peninsular Malaysia, W89-02739
claimed Coal-Mine Spoil, Northwest New	Effects of Future Ground-Water Pumpage on	
Mexico, W89-02360 2F	the High Plains Aquifer in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma,	Limestone Weathering Under a Soil Cover and the Evolution of Limestone Pavements, Malham District, North Yorkshire, UK.
ISOTOPIC STUDIES Use of Linear Compartmental Simulation Ap-	South Dakota, Texas, and Wyoming, W89-03031 2F	W89-02740 2J
proach for Quantitative Interpretation of Isotope		Kamenitzas of Gait Barrows National Nature
Data under Time Variant Flow Conditions, W89-03017 7C	Pesticides in Fish Tissue and Water from Tuttle Creek Lake, Kansas,	Reserve, North Lancashire, England, W89-02741 2F
	W89-03317 5B	
ISOTOPIC TRACERS Stable Isotopes: An Investigation into Their Ap-	KARST	Valley Excavation in the Yorkshire Dales Karst, W89-02742
plication in Karst Hydrology in the U.K., with Special Reference to the Malham Area, North	New Directions in Karst. W89-02728 2F	Identification of a Karst Hydrological System in
Yorkshire, W89-02734 2F	Alkalinity Measurements in Karst Water Stud-	the Dinaric Karst (Yugoslavia), W89-03052 2F
	ies, W89-02729 2F	
Isotopic Investigation on the Evolution of Groundwater Dynamics in the Principal	Controls on the Composition of Authigenic Per-	KARSTHYDROLOGY Chemical Weathering of the East Yorkshire
Aquifers in the Southern Dobrudja,	colation Water in the Burren, Ireland,	Chalk,
W89-02853 2F	W89-02730 2K	W89-02731 2K
General Review of Methodologies and Ap- proaches in Mathematical Models for Interpreta- tion of Tracer Data in Hydrology,	Phytokarst, Blue-green Algae and Limestone Weathering, W89-02732 2K	KENTUCKY Superfund Record of Decision: Distler Farm,
W89-03011 2F		KY. W89-02778 5G
Pu(239,240) Residence Times in Freshwaters	Geological Structure: An Important Factor Controlling Karst Development,	Martins Fork Lake Sedimentation Study: Hy-
and Accumulation in Shield Lake Sediments,	W89-02733 2F	draulic Model Investigation,
W89-03209 2H	Karst Water Temperature and the Shaping of	W89-02780 2J
ISRAEL	Malham Cove, Yorkshire, W89-02737 2F	KILLIFISH
Groundwater Contamination by Nitrates and Chlorides Washed out from Phosphorite Ores in the Negev Desert, Israel,	Chemical Erosion in Tower Karst Terrain,	Diversity of the Parasite Assemblage of Fundu- lus zebrinus in the Platte River of Nebraska, W89-03062 2H
W89-03147 5B	Kinta Valley, Peninsular Malaysia, W89-02738 2J	
JAMES BAY	Hydrological Development of Tropical Tower	Reactions and Transport of Trace Metals in
Change in Sedimentation Following River Di- version in the Eastmain Estuary (James Bay), Canada,	Karst: An Example from Peninsular Malaysia, W89-02739 2F	Groundwater, W89-02644 5B
W89-03186 2J	Kamenitzas of Gait Barrows National Nature	Kinetics of Low Solids Bio-denitrification of
JAMES RIVER BASIN	Reserve, North Lancashire, England, W89-02741 2F	Water Supplies, W89-03166 5F
Drainage Areas in the James River Basin in Eastern South Dakota,		
W89-02515 7C	Report on Hydrogeological Maps of Karstic Terrains,	KISHWAUKEE RIVER Intensive Survey of the Kishwaukee River and its Tributaries, 1983.
JAPAN Some Relationships Between Debris Flow	W89-02389 2F	W89-02858 5C
Motion and Micro-Topography for the Kamika-	New Directions in Karst.	KOREA
mihori Fan, North Japan Alps, W89-02907 2J	W89-02728 2F	Review of Groundwater in the Republic of
Microflagellate-Picoplankton Food Linkage in	Alkalinity Measurements in Karst Water Stud-	Korea, W89-02376
the Water Column of Lake Biwa,	ies, W89-02729 2F	Treatment of Potable Water from Seoul, Kores
W89-03245 2H	Geological Structure: An Important Factor	by Flotation, Filtration and Adsorption,
Mass Balance of Heavy Metals in the Seto Inland Sea, Japan.	Controlling Karst Development, W89-02733 2F	W89-03319 5F
W89-03278 5B		KRAFT MILLS Physiological Disturbances in Fish Living in
JEFFERSON BARRACKS BRIDGE Jefferson Barracks Bridge, Movable-Bed Model	Stable Isotopes: An Investigation into Their Ap- plication in Karst Hydrology in the U.K., with Special Reference to the Malham Area, North	Coastal Water Polluted with Bleached Kraf Pulp Mill Effluents,
Study,	Yorkshire,	W89-03234 50
W89-02417 2J	W89-02734 2F	LAGOONS
JUBILEES Mobile Bay Estuary: Stratification, Oxygen De-	Stormflow Characteristics of Three Small Lime-	Laguna Madre of Texas: Hydrography of a Hy
pletion, and Jubilees,	stone Drainage Basins in North Island, New Zealand,	persaline Lagoon, W89-02695 21
W89-02696 2L	W89-02735 2A	Assimilative Capabilities of Retention Ponds,
KAMENITZAS	Groundwater Flow in the Lowland Limestone	W89-02856 5I
Kamenitzas of Gait Barrows National Nature Reserve, North Lancashire, England,	Aquifer of Eastern Co. Galway and Eastern Co. Mayo, Western Ireland,	Coastal Lagoons of East Anglia, U.K.,
W89-02741 2F	W89-02736 2F	W89-03184 21

LAGOONS

Cycling of Methane, Carbon Monoxide, Nitrous	LAKE MORPHOMETRY	Comparison of Microbial Dynamics in Marine
Oxide, and Hydroxylamine in a Meromictic,	Littoral Zoobenthic Biomass in Lakes, and Its	and Freshwater Sediments: Contrasts in Anaero-
Coastal Lagoon,	Relationship to Physical, Chemical, and Trophic	bic Carbon Catabolism, W89-03257 2H
W89-03191 2L	Factors, W89-03229 2H	W 65-03237 211
LAGRANGIAN EQUATIONS	11 07-03227	LAKE SHARPE
Lagrangian-Eulerian Approach to Modeling	LAKE PONTCHARTRAIN	Limnological and Fishery Studies on Lake
Hydrogeochemical Transport of Multi-Compo-	Clam Shell Dredging in Lakes Pontchartrain	Sharpe, a Main-stem Missouri River Reservoir, 1964-1975.
nent Systems, W89-03320 5B	and Maurepas, Louisiana, W89-02715 6G	W89-02423 2H
	W 65-02/15	
LAGRANGIAN MODELING	LAKE RESTORATION	Physical, Chemical, and Biological Characteris- tics of Lake Sharpe, South Dakota, 1966-1975,
Eulerian and Lagrangian Modeling of Estuarine Hydrodynamics,	Treatment of Filter Effluents from Dewatering	W89-02424 2H
W89-02691 2L	of Sludges by a New High Performance Floccu- lation Reactor,	
	W89-02819 5D	Zooplankton Biomass Exchange in Lake Sharpe,
LAGUMA MADRE		South Dakota, 1974-1975, W89-02425 2H
Laguna Madre of Texas: Hydrography of a Hy- persaline Lagoon,	Fate of Added Alkalinity During Neutralization	
W89-02695 .2L	of Acid Lake, W89-03111 5G	Relative Abundance and Distribution of Young-
TANDA OLUMBA	W07-03111	of-the-Year Fishes and Minnows in Lake Sharpe, South Dakota,
LAKE-AQUIFER SYSTEMS Modeling the Response of Lake-Aquifer Sys-	Effects of Liming on the Distribution of Cadmi-	W89-02426 2H
tems to Acid Precipitation,	um in Water, Sediment, and Organisms in a	
W89-02341 5C	Swedish Lake, W89-03224 5B	Biology of the Walleye in Lake Sharpe, South
T. DE CATTEREN	W 65-03224	Dakota, 1964-1975, W89-02427 2H
Preliminary Environmental Assessment of the	LAKE SAINT CLAIR	W 69-02-427
Contamination Associated with Lake Calumet,	Total Phosphorus Budget for Lake St. Clair:	Biology of the Yellow Perch in Lake Sharpe,
Cook County, Illinois,	1975-80, W89-03168 5B	South Dakota, 1964-1975, W89-02428 2H
W89-02870 5B	W07-03100	W 65-02426 2H
LAKE CHAMPLAIN	LAKE SEDIMENTS	Early Life History and Winter Mortality of Giz-
Analysis of Agricultural Nonpoint Pollution	Horizontal and Vertical Distribution of PCBs in	zard Shad in Lake Sharpe, South Dakota, W89-02429 2H
Control Options in the St. Albans Bay Water-	Southern Lake Michigan Sediments and the Effect of Waukegan Harbor as a Point Source,	W 89-02429 2H
shed,	W89-03170 5B	LAKE WASHINGTON
W89-02419 5G	I CHANGE OF STATE OF THE STATE	Methane Cycling in the Sediments of Lake
LAKE ERIE	Interstitial Water Quality of Lake Trout Spawn- ing Habitat,	Washington, W89-03249 2H
Final Report: Lake Erie Conservation Tillage	W89-03172 5C	11 05-03245
Demonstration Projects. W89-02835 3F		LAKES
W 65-02633	Pu(239,240) Residence Times in Freshwaters and Accumulation in Shield Lake Sediments,	Sources of Alkalinity in Precambrian Shield Wa- tersheds Under Natural Conditions and After
Lake Erie Conservation Tillage Demonstration	W89-03209 2H	Fire or Acidification,
Projects: Evaluating Management of Pesticides, Fertilizer, Residue to Improve Water Quality.		W89-02313 2G
W89-02837 3F	Prediction of Phosphorus Release Rates from	Natural History of Lakes,
	Total and Reductant-Soluble Phosphorus in Anoxic Lake Sediments,	W89-02775 2H
LAKE EVAPORATION Determination of Evaporation and Seepage	W89-03210 2H	
Losses, Upper Lake Mary near Flagstaff, Arizo-		Chemical and Biological Survey of Lakes and
ma,	Silica and Phosphorus Flux from Sediments: Im-	Streams Located in the Emerald Lake Water- shed, Sequoia National Park,
W89-02558 2H	portance of Internal Recycling in Lake Michigan,	W89-02852 2H
LAKE GREAT LAKES	W89-03219 2H	
Historical Basis for Limits on Lake Superior		Survey of Sensitivity of Southern California Lakes to Acid Deposition,
Water Level Regulations,	Sediment Record of Biogeochemical Responses to Anthropogenic Perturbations of Nutrient	W89-02864 5C
W89-03173 4A	Cycles in Lake Ontario,	
LAKE ICE	W89-03222 2H	Volunteer Lake Monitoring Program, 1987. Volume I: Statewide Summary Report,
Operations for an Under-Ice Ecology Program,	Effects of Visites and Distriction of Co. 1	W89-02869 7B
W89-03179 2H	Effects of Liming on the Distribution of Cadmi- um in Water, Sediment, and Organisms in a	
LAKE MAUREPAS	Swedish Lake,	Preliminary Environmental Assessment of the
Clam Shell Dredging in Lakes Pontchartrain	W89-03224 5B	Contamination Associated with Lake Calumet, Cook County, Illinois,
and Maurepas, Louisiana,	Scaled Chargeshytes (Chargeshytes)	W89-02870 . 5B
W89-02715 6G	Scaled Chrysophytes (Chrysophyceae) as Indi- cators of pH in Sudbury, Ontario, Lakes,	
LAKE MICHIGAN	W89-03227 5A	Western Lake Survey, Phase I. Data Base. W89-02946 2H
Lake Michigan Water Quality Report January		11 03-023-10
through December, 1986.	Phosphorous Flux from Lake Sediments: Effect of Epipelic Algal Oxygen Production,	Aquatic Macrophytes in Adirondack (New
W89-02867 5B	W89-03248 2H	York) Lakes: Patterns of Species Composition in Relation to Environment,
Horizontal and Vertical Distribution of PCBs in		W89-03056 5C
Southern Lake Michigan Sediments and the	Methane Cycling in the Sediments of Lake Washington.	
Effect of Waukegan Harbor as a Point Source, W89-03170 5B	W89-03249 2H	Sensitivity of Meander Lake to Acid Deposition, W89-03110 5C
Silica and Phosphorus Flux from Sediments: Im-	Nitrogen Fixation in Freshwater, Estuarine, and	,
portance of Internal Recycling in Lake Michi- gan,	Marine Ecosystems: 1. Rates and Importance, W89-03254 2H	OI I TOTAL MARKET
W89-03219 2H		
Dynamics of Lake Michigan Phytoplankton: Re-	Denitrification in Freshwater and Coastal	
lationship to Nitrogen and Silica Fluxes,	Marine Ecosystems: Ecological and Geochemi- cal Significance,	Located Partly within a National Nature Re- serve and Site of Special Scientific Interest,
W89-03230 2H		

Total Phosphorus Budget for Lake St. Clair: 1975-80, W89-03168 5B	mation of Direct Photolysis and Persistence of Formulation Impurities in a Stream During Treatment, W89-03175 5B	Pilot Scale Evaluation of Sludge Landfilling: Four Years of Operation, W89-02978 5E
Prediction of Phosphorus Release Rates from Total and Reductant-Soluble Phosphorus in Anoxic Lake Sediments, W89-03210 2H	W89-03175 5B LAND DISPOSAL Land Treatment of Nitroguanidine Wastewater, W89-02293 5D	Effect of Unsaturated/Saturated Zone Property Upon the Hydrogeochemical and Microbiologi- cal Processes Involved in the Migration and
		Attenuation of Landfill Leachate Components, W89-03087 5B
Comparison of In Situ Estimates of Chlorophyll a Obtained with Whatman GF/F and GF/C Glass-Fiber Filters in Mesotrophic to Hypereu- tophic Lakes,	How Clean Is Clean. (What Constitutes the Clean Closure of a Hazardous Waste Land Man- agement Facility), W89-02399 5E	Leachate Collection in Landfills: Steady Case, W89-03102 5E
W89-03217 7B	Economic And Environmental Impacts of Using	Groundwater Contamination at a Landfill Sited
Comparison of Phosphorus Dynamics in Two Oklahoma Reservoirs and a Natural Lake Vary- ing in Abiogenic Turbidity,	Municipal Sewage Effluent for Agricultural Production,	on Fractured Carbonate and Shale, W89-03146 5B
W89-03232 2H	W89-02663 5E	LANDSLIDES
Growth and Phosphorous Status of Limnetic Phytoplankton and Bacteria,	Regulation of the Agricultural Utilization of Sewage Sludge in New Jersey, W89-02676 5E	Landsliding, Slope Development and Sediment Yield in a Temperate Environment: Northeast Romania,
W89-03244 2H		W89-02897 2J
Microflagellate-Picoplankton Food Linkage in the Water Column of Lake Biwa,	LAND MANAGEMENT Assessment of Hydrogeological Features Using	LASER INDUCED PHOTOACOUSTIC
W89-03245 2H	the Technique of Terrain Classification, W89-02372 7B	SPECTROSCOPY Characterization of Colloids in Groundwater,
Phosphorous Flux from Lake Sediments: Effect	LAND RECLAMATION	W89-02998 2K
of Epipelic Algal Oxygen Production, W89-03248 2H	Recovery of Moisture/Solute Profiles in Re-	LEACHATES
Denitrification in Freshwater and Coastal	claimed Coal-Mine Spoil, Northwest New Mexico,	Effect of Unsaturated/Saturated Zone Property Upon the Hydrogeochemical and Microbiologi-
Marine Ecosystems: Ecological and Geochemi-	W89-02360 2F	cal Processes Involved in the Migration and
cal Significance, W89-03256 2H	LAND SUBSIDENCE	Attenuation of Landfill Leachate Components, W89-03087 5B
Comparative Ecology of Submersed Grass Beds	Groundwater Withdrawals and Changes in Groundwater Quality and Land Surface Subsid-	
in Freshwater, Estuarine, and Marine Environ- ments.	ence in the Houston District, Texas, W89-02519 6G	Leachate Collection in Landfills: Steady Case, W89-03102 5E
W89-03264 2H		Phosphate Requirement for Anaerobic Fixed
Forested Wetlands in Freshwater and Salt-	Economic And Environmental Impacts of Using	Film Treatment of Landfill Leachate, W89-03132 5D
Water Environments, W89-03265 2H	Municipal Sewage Effluent for Agricultural Production,	
	W89-02663 5E	Groundwater Contamination at a Landfill Sited on Fractured Carbonate and Shale,
Production and Use of Detritus in Various Freshwater, Estuarine, and Coastal Marine Eco-	LAND USE	W89-03146 5B
systems, W89-03266 2H	Hydrology of Area 62, Northern Great Plains and Rocky Mountain Coal Provinces-New	Stringfellow Leachate Treatment with RBC,
Ecological Principles Affecting Community	Mexico and Arizona, W89-02498 2F	W89-03328 5D
Structure and Secondary Production by Zoo- plankton in Marine and Freshwater Environ-	The state of the s	LEACHING Soil Acidification and Metal Solubility in For-
ments, W89-03267 2H	Relation of Water Chemistry of the Edwards Aquifer to Hydrogeology and Land Use, San	ests of Southern Sweden, W89-02308 5E
Comparative Ecology of the Macrofauna of	Antonio Region, Texas, W89-02514 5B	
Freshwater and Marine Muds, W89-03268 2H	Toward Sustaining a Desert Metropolis: Water and Land Use in Tucson, Arizona,	Differences in Aluminum Mobilization in Spodo sols in New Hampshire (USA) and in the Neth erlands as a Result of Acid Deposition,
Physical Energy Inputs and the Comparative	W89-02637 6D	W89-02309 51
Ecology of Lake and Marine Ecosystems, W89-03272 2A	Synoptic-Scale Assessment of Surface Runoff, W89-02703 2E	Limits on Cation Leaching of Weakly Podzo lized Forest Soils: An Empirical Evaluation,
Effects of Cadmium Exposure on Feeding of	Modification and Assessment of an Index of	W89-02310 51
Freshwater Planktonic Crustaceans, W89-03288 5C	Biotic Integrity to Quantify Stream Quality in	Bacterial Leaching of Heavy Metals from An
Pesticides in Fish Tissue and Water from Tuttle	Southern Ontario, W89-03211 4C	aerobically Digested Sludge, W89-02925 51
Creek Lake, Kansas, W89-03317 5B	LANDFILL COVER	Results of Experiments Related to Contact of
	Evaluation of Municipal Solid Waste Landfill	Mine-Spoils Water with Coal, West Decker an
Organic Contaminants in Isolated Lakes of Sor hern Labrador, Canada,	Cover Designs, W89-02871 5E	Big Sky Mines, Southeastern Montana, W89-03001 5
W.9-03318 5B	LANDFILLS	Investigations on Leaching of Dicyandiamid
LAMPREY Photodegradation of the Lampricide 3 Trifluor	Field Simulation of Waste Impoundment Seep-	and its Decomposition in Flooded Soils (Unte
Photodegradation of the Lampricide 3-Trifluor- omethyl-4-nitrophenol (TFM): 2. Field Confir-	age in the Vadose Zone, W89-02348 5B	suchungen zur Auswaschung von Dicyandiami und Dessen Abbau in Uberstauten Boden),
mation of Direct Photolysis and Persistence of Formulation Impurities in a Stream During	Superfund Record of Decision: Combe Fill	W89-03043 5
Treatment,	North Landfill, NJ.	LEAD
W89-03175 5B	W89-02707 5G	Recent Acidification of a Large Scottish Loc
LAMPRICIDES Photodegradation of the Lampricide 3-Trifluor-	Evaluation of Municipal Solid Waste Landfill Cover Designs,	Located Partly within a National Nature R serve and Site of Special Scientific Interest,
omethyl-4-nitrophenol (TFM): 2. Field Confir-	W89-02871 5E	

5C

Distribution of Contaminants in Clams and Sedi-	LIME	Biology of the Walleye in Lake Sharpe, South
ments from the Huron-Erie Corridor: II. Lead	Effects of Liming on the Distribution of Cadmi-	Dakota, 1964-1975, W89-02427 2H
and Cadmium, W89-03177 5B	um in Water, Sediment, and Organisms in a Swedish Lake,	
ALL I A A A A A A A A A A A A A A A A A	W89-03224 5B	Biology of the Yellow Perch in Lake Sharpe,
Effects of Temperature, Salinity and Seagrass	E TA ATTOMONYE	South Dakota, 1964-1975, W89-02428 2H
Species on the Uptake of Lead(II) from Sea- water by Excised Leaves,	Report on Hydrogeological Maps of Karstic	
W89-03275 5B	Terrains,	Early Life History and Winter Mortality of Giz-
	W89-02389 2F	zard Shad in Lake Sharpe, South Dakota, W89-02429 2H
Biogeochemistry of Lead-210 and Polonium-210	Stormflow Characteristics of Three Small Lime-	W 89-02429 2H
in Fresh Waters and Sediments,	stone Drainage Basins in North Island, New	Water Quality Assessment of Arvada Reservoir,
W89-02555 2K	Zealand,	Denver Metropolitan Area, Colorado,
	W89-02735 2A	W89-02562 2H
LEAK DETECTION Applying Electrical Resistance Blocks for Un-	Groundwater Flow in the Lowland Limestone	Spirit Lake, Mount St. Helens, Washington,
saturated Zone Monitoring at Arid Sites,	Aquifer of Eastern Co. Galway and Eastern Co.	Limnological and Bacteriological Investigations.
W89-02352 7B	Mayo, Western Ireland,	Final Report, Volume I, W89-02709 2H
TECAT ACRECAS	W89-02736 2F	
LEGAL ASPECTS Pretreatment of Industrial Wastewater: Legal	Limestone Weathering Under a Soil Cover and	Spirit Lake, Mount St. Helens, Washington,
and Planning AspectsA Case Study,	the Evolution of Limestone Pavements, Malham	Limnological and Bacteriological Investigations. Final Report, Volume II, Appendices,
W89-02800 5D	District, North Yorkshire, UK,	W89-02710 2H
LEGISLATION	W89-02740 2J	
Impacts of Recharge Legislation on Groundwat-	Hydrology and Solute Uptake in Hillslope Soils	Natural History of Lakes, W89-02775 2H
er Management in Arizona,	on Magnesian Limestone: the Whitwell Wood	W 69-02773 2H
W89-02336 4B	Project,	Intensive Survey of the DuPage River Basin,
Liability for Managing Hazardous Wastes: Past,	W89-02891 2G	1983.
Present and Future,	LIMESTONE COUNTY	W89-02829 5G
W89-02398 6E	Groundwater Resources of Limestone County,	Intensive Survey of the Fox River Basin from
Supplemental Final Development Document for	Texas,	the Wisconsin State Line to Ottawa, Illinois:
Effluent Limitations Guidelines, New Source	W89-02583 2F	1982. W89-02841 5G
Performance Standards and Pretreatment Stand-	LIMITING NUTRIENTS	W 65-02641
ards for the Leather Tanning and Finishing	Contrasting Patterns of Net- and Nanoplankton	Chemical and Biological Survey of Lakes and
Point Source Category.	Production and Biomass Among Lakes,	Streams Located in the Emerald Lake Water-
W89-02832 6E	W89-03218 2H	shed, Sequoia National Park, W89-02852 2H
River Conservation - Implications for Legisla-	Growth and Phosphorous Status of Limnetic	
tion,	Phytoplankton and Bacteria,	Western Lake Survey, Phase I. Data Base.
W89-02992 6E	W89-03244 2H	W89-02946 2H
LICHENS	Nutrient Limitation of Phytoplankton in Fresh-	Ecological Research on South African Rivers -
Phytokarst, Blue-green Algae and Limestone	water and Marine Environments: A Review of	A Preliminary Synthesis,
Weathering, W89-02732 2K	Recent Evidence on the Effects of Enrichment,	W89-02982 2H
W89-02732 2K	W89-03261 2H	Riverine Ecosystems,
LIFE HISTORY STUDIES	LIMNOLOGY	W89-02986 2H
Chlorine Sensitivity of Early Life Stages of	Comparison of Lake Sediments and Ombrotro-	Diversity of the Parasite Assemblage of Fundu-
Freshwater Fish, W89-03333 5C	phic Peat Deposits as Long-Term Monitors of	lus zebrinus in the Platte River of Nebraska,
W 65-05333	Atmospheric Pollution, W89-02321 5A	W89-03062 2H
LIGHT INTENSITY		Model Calibration Based on Random Environ-
Numerical Model for the Computation of Radi-	Review of the Crater Lake Limnological Pro-	mental Fluctuations,
ance Distributions in Natural Waters with Wind- Roughened Surfaces, Part II: User's Guide and	grams, W89-02322 2H	W89-03105 7A
· Code Listing,		Interpretation of 'Controlled' vs 'Natural' Ex-
W89-02414 2H	Modeling the Response of Lake-Aquifer Sys-	periments in Streams,
LIGHT PENETRATION	tems to Acid Precipitation, W89-02341 5C	W89-03117 7A
Relationships Among Secchi Disk Depth, Beam	W 03-02341 3C	Total Phosphorus Budget for Lake St. Clair:
Attenuation Coefficient, and Irradiance Attenu-	National Surface Water Survey, Western Lake	1975-80.
ation Coefficient for Great Lakes Waters,	Survey (Phase I Synoptic Chemistry) Quality	W89-03168 5B
W89-03176 2H	Assurance Plan, W89-02413 2H	Nonparametric Evaluation of the Size of Limno-
Operations for an Under-Ice Ecology Program,		logical Sampling Networks: Application to the
W89-03179 2H	Limnological and Fishery Studies on Lake	Design of a Survey of Green Bay,
Interrelationship Between In Vivo Fluorescence	Sharpe, a Main-stem Missouri River Reservoir, 1964-1975,	W89-03174 7A
of Phytoplankton and Light Beam Transmission	W89-02423 2H	Prediction of Phosphorus Release Rates from
with Reference to Fluorescence Yield,		Total and Reductant-Soluble Phosphorus in
W89-03233 2L	Physical, Chemical, and Biological Characteris- tics of Lake Sharpe, South Dakota, 1966-1975,	Anoxic Lake Sediments,
LIGNITE	W89-02424 2H	W89-03210 2H
Hydrology of Area 59, Northern Great Plains		Photosynthetic Carbon Metabolism by Phyto-
and Rocky Mountain Coal Provinces, Colorado	Zooplankton Biomass Exchange in Lake Sharpe,	plankton in a Nitrogen-Limited Reservoir,
and Wyoming, W89-02501 2E	South Dakota, 1974-1975, W89-02425 2H	W89-03215 2H
		Comparison of In Situ Estimates of Chlorophyll
Hydrogeochemistry of the Upper Part of the		a Obtained with Whatman GF/F and GF/C
Fort Union Group in the Gascoyne Lignite Strip-Mining Area, North Dakota,	of-the-Year Fishes and Minnows in Lake Sharpe, South Dakota,	Glass-Fiber Filters in Mesotrophic to Hypereu- tophic Lakes,
W89-03026 4C		W89-03217 7B

Contrasting Patterns of Net- and Nanoplankton Production and Biomass Among Lakes,	plankton in Marine and Freshwater Environ- ments,	Recent Advances in Magnetic Processes, W89-02961 5D
W89-03218 2H	W89-03267 2H	Role of Tracer Methods in Hydrology as a
Silica and Phosphorus Flux from Sediments: Importance of Internal Recycling in Lake Michigan,	Comparative Ecology of the Macrofauna of Freshwater and Marine Muds, W89-03268 2H	Source of Physical Information: Basic Concepts and Definitions, Time Relationship in Dynamic Systems.
W89-03219 2H	Accounting for Effort When Comparing Tropi-	W89-03010 7B
Contrasting Diel Patterns of Vertical Migration	cal Fisheries in Lakes, River-Floodplains, and	General Review of Methodologies and Ap-
in the Dinoflagellate Ceratium hirundinella in Relation to Phosphorus Supply in a North Tem-	Lagoons, W89-03269 2H	proaches in Mathematical Models for Interpreta- tion of Tracer Data in Hydrology,
perate Reservoir, W89-03221 2H	Applicability of Fish Yield Indices in Freshwa-	W89-03011 2F
	ter and Marine Ecosystems, W89-03270 2H	Review of Existing Mathematical Models for
Scaled Chrysophytes (Chrysophyceae) as Indi- cators of pH in Sudbury, Ontario, Lakes,	Freshwater and Marine Coupling in Estuaries of	Interpretation of Tracer Data in Hydrology, W89-03012 2F
W89-03227 5A	the Mississippi River Deltaic Plain,	LITTER
Littoral Zoobenthic Biomass in Lakes, and Its Relationship to Physical, Chemical, and Trophic	W89-03271 2E Physical Energy Inputs and the Comparative	Secondary Production and Trophic Relation- ships in a Spring Invertebrate Community,
Factors,	Ecology of Lake and Marine Ecosystems,	W89-03250 2H
W89-03229 2H	W89-03272 2A	LITTORAL ENVIRONMENT
Dynamics of Lake Michigan Phytoplankton: Re-	Prediction of Reservoir Phytoplankton Condi-	Flora and Macrofauna of Intertidal Sediments,
lationship to Nitrogen and Silica Fluxes, W89-03230 2H	tion by the Fluorescence Method, W89-03291 2H	W89-02763 2L
Growth and Phosphorous Status of Limnetic	Effect of Climate on Development of Two	Littoral Zoobenthic Biomass in Lakes, and Its Relationship to Physical, Chemical, and Trophic
Phytoplankton and Bacteria,	Sphagnum Bogs in South-Central Wisconsin,	Factors,
W89-03244 2H	W89-03293 2H	W89-03229 2H
Microflagellate-Picoplankton Food Linkage in the Water Column of Lake Biwa,	Fertility and Disturbance Gradients: A Summa- ry Model for Riverine Marsh Vegetation,	LITTORAL ZONE
W89-03245 2H	W89-03294 2H	Intertidal Rock, W89-02767 2L
Phosphorous Flux from Lake Sediments: Effect	Hydrochory and Regeneration in a Bald Cy-	LOAD DISTRIBUTION
of Epipelic Algal Oxygen Production,	press-Water Tupelo Swamp Forest, W89-03295 2H	Load-Sharing Linings: A New Design Concept
W89-03248 2H	LINERS	for Large Diameter Penstocks, W89-03158
Methane Cycling in the Sediments of Lake Washington,	Factors in Assessing the Compatibility of FMLs	LOCH LAIDON
W89-03249 2H	and Waste Liquids, W89-02952 5E	Recent Acidification of a Large Scottish Loch
Nitrogen Fixation in Freshwater, Estuarine, and Marine Ecosystems: 1. Rates and Importance,	Leachate Collection in Landfills: Steady Case,	Located Partly within a National Nature Re- serve and Site of Special Scientific Interest,
W89-03254 2H	W89-03102 5E	W89-03125 5C
Nitrogen Fixation in Freshwater, Estuarine, and Marine Ecosystems: 2. Biogeochemical Con-	LININGS Load-Sharing Linings: A New Design Concept	LONG-TERM PLANNING Projections of Water Availability in the Lower
trols,	for Large Diameter Penstocks, W89-03158 8F	Rio Grande, Gila-San Francisco and Mimbres Drainage Basins to 2005,
W89-03255 2H	LIQUID SLUDGE	W89-02474 6D
Denitrification in Freshwater and Coastal Marine Ecosystems: Ecological and Geochemi-	Pretreatment of Sludge Liquors in Sewage	LONG-TERM STUDIES
cal Significance,	Treatment Plants, W89-02817 5D	Monitoring and Quality Assurance Procedures for the Study of Remote Watershed Ecosystems,
W89-03256 2H	LITERATURE	W89-02330 5A
Comparative Ecology of Marine and Freshwater Phytoplankton,	Water Resources Publications of the U.S. Geo-	LOS ANGELES
W89-03260 2H	logical Survey, For Tennessee, 1906-1987, W89-02467 10C	Use of Well Packers To Control TCE and PCE Contaminants,
Nutrient Limitation of Phytoplankton in Fresh-	LITERATURE REVIEW	W89-02356 5G
water and Marine Environments: A Review of Recent Evidence on the Effects of Enrichment,	Great American Desert Transformed: Aridity, Exploitation, and Imperialism in the Making of	LOS ANGELES BASIN
W89-03261 2H	the Modern American West,	Impact of the Newport-Inglewood Structural Zone on Hydrogeologic Mitigation Efforts: Los
Nuisance Phytoplankton Blooms in Coastal, Es-	W89-02632 6D	Angeles Basin, California,
tuarine, and Inland Waters, W89-03262 2H	Nitrates and Pesticides in Ground Water: An Analysis of a Computer-Based Literature	W89-02342 2F
	Search,	LOUISIANA Pumpage of Water in Louisiana, 1985,
Comparative Ecology of Submersed Grass Beds in Freshwater, Estuarine, and Marine Environ-	W89-02666 5B	W89-02506 6D
ments, W89-03264 2H	Review of 183 GHz Moisture Profile Retrieval Studies,	Water Level Measurements 1981-85 and Chemi-
	W89-02705 7C	cal Analyses 1978-85, Red River Alluvial Aqui-
Forested Wetlands in Freshwater and Salt- Water Environments,	Acid Precipitation Literature Review 1986:	fer, Red River Valley, Louisiana, W89-02582 7C
W89-03265 2H	Emission, Transport, Transformation and Depo- sition of Acidic Trace Species,	Clam Shell Dredging in Lakes Pontchartrain
Production and Use of Detritus in Various	W89-02822 5B	and Maurepas, Louisiana,
Freshwater, Estuarine, and Coastal Marine Eco- systems,	Review of Papers Published in 1985 about Emis-	W89-02715 6G
W89-03266 2H	sion, Transport, Transformation and Deposition of Atmospheric Trace Constituents of Impor-	Experiences with Granular Activated Carbon Filtration and On-Site Reactivation at Jefferson
Ecological Principles Affecting Community	tance for Acid Deposition,	Parish, Louisiana,
Structure and Secondary Production by Zoo-	W89-02827 5B	W89-02790 5F

LOW FLOW

LOW FLOW	Updating and Refurbishing Hydro Plants in	MAPLE TREES
Statistical Analyses of Flood Frequency, Low-	India,	Effects of Simulated Acid Rain on Sugar Maple
Flow Frequency and Flow Duration of Streams	W89-03155 8C	Seedling Root Growth,
in the Philadelphia Area, Pennsylvania,	110700100	W89-03300 5C
W89-02492 2E	Extending the Operating Life of Hydro Equip-	
W 07-02472	ment,	MAPPING
Regionalization of Winter Low-flow Character-	W89-03156 8C	Hydrogeological Mapping in Asia and the Pacif-
istics of Tennessee Streams,	11 07 05 150	ic Region.
W89-03005 2E	Uprating of Four Indian Hydro Plants,	W89-02364 7B
	W89-03157 8C	W 67-02504
LUXEMBOURG	W85-03157	Assessment and Mapping of Australia's Ground-
Surface and Subsurface Sources of Suspended	MALATHION	water Resources,
Solids in Forested Drainage Basins in the	Acute Toxicity of Malathion, Tetrabromobis-	W89-02365 2F
Keuper Region of Luxembourg,	phenol-A, and Tributyltin Chloride to Mysids	W 87-02303
W89-02892 2J	(Mysidopsis bahia) of Three Ages,	Hydrogeological Mapping in Fiji,
	W89-03203 5C	W89-02366 2F
Sources of Variation of Soil Erodibility in	W 67-03203	
Wooded Drainage Basins in Luxembourg,	MALAYSIA	Position Paper: Solomon Islands,
W89-02893 2J	Status of Hydrogeological Mapping in Peninsu-	W89-02367 2F
	lar Malaysia.	
MACROINVERTEBRATES	W89-02377 2F	Hydrogeological Development in Vanuatu,
Pesticide Impact on Stream Fauna with Special	W 07-02311	W89-02368 2F
Reference to Macroinvertebrates,	Chemical Erosion in Tower Karst Terrain,	
W89-02773 5C	Kinta Valley, Peninsular Malaysia,	Development and Achievements of Hydrogeolo-
Tiffe at all Charles are Photostics Flows on	W89-02738 2J	gical Mapping in China,
Effects of Steady versus Fluctuating Flows on	W 87-02/30 23	W89-02370 2F
Aquatic Macroinvertebrates in the Colorado	Hydrological Development of Tropical Tower	
River below Glen Canyon Dam, Arizona,	Karst: An Example from Peninsular Malaysia,	Groundwater in China,
W89-02940 6G	W89-02739 2F	W89-02371 2F
MACROPHYTES	W 69-02/39 2F	
	MANAGEMENT PLANNING	Assessment of Hydrogeological Features Using
Above- and Below-Ground Macrophyte Pro- duction in Scirpus Tidal Marshes of the St.		the Technique of Terrain Classification,
	Wastewater Treatment: Optimizing an Existing	W89-02372 7B
Lawrence Estuary, Quebec,	System,	
W89-03055 2L	W89-02406 5D	Groundwater Resources Development and Man-
Aquatic Macrophytes in Adirondack (New	Environmental Auditing Management's Van to	agement in India,
York) Lakes: Patterns of Species Composition in	Environmental Auditing: Management's Key to	W89-02373 2F
Relation to Environment,	Effective Environmental Compliance,	
W89-03056 5C	W89-02409 6A	Hydrogeological Problems of Hard Rock Areas
W 89-03036		of Southern India,
Effect of Submersed Aquatic Macrophytes on	U.S.D.A. Agricultural Research Service Com-	W89-02374 2F
Resource Partitioning in Yearling Rock Bass	midment to Ground Water Research,	
(Ambloplites rupestris) and Pumpkinseeds (Le-		Status of Hydrogeological Mapping in Indonesia
pomis gibbosus) in Lake St. Clair,		in 1983,
W89-03171 2H	Developing a State Ground Water Policy in the	W89-02375 7B
W05-051/1 211	com zon mo rowa care,	C
Influence of Nutrient Enrichment and Light	W89-02681 2F	Status of Hydrogeological Mapping in Peninsu-
Availability on the Abundance of Aquatic Ma-		lar Malaysia,
crophytes in Florida Streams,	rijorotogi versus water resources manage	W89-02377 2F
W89-03231 5C	ment,	N
	W89-02724 2A	Notes on the Hydrogeological Map of Sarawak,
Effect of Climate on Development of Two	It's Your Choice: A Guidebook for Local Offi-	W89-02378 2F
Sphagnum Bogs in South-Central Wisconsin,		Water Resources and Hydrogeological Mapping
W89-03293 2H	cials on Small Community Wastewater Manage-	
	ment Options.	in the Mongolian People's Republic, W89-02379 2F
MAGNESIUM HYDROXIDE	W89-02838 5D	W89-02379 2F
Howard Plating Clean Up Their Act with Mag-	Weste Minimization Audit Beneat, Com Studies	PakistanStatus Report,
nesium Hydroxide,	Waste Minimization Audit Report: Case Studies	
W89-02401 5E	of Minimization of Solvent Wastes and Electro-	W89-02381 4E
	plating Wastes at a DOD (Department of De-	Hydrogeological Mapping in the Philippines,
MAGNETIC SEPARATION	fense) Installation,	W89-02382 2F
Recent Advances in Magnetic Processes,	W89-02839 5D	W 07-02362
W89-02961 5E	MANGANESE	Status of Hydrogeological Mapping in Thailand
MATTANEANCO CINERE		W89-02384 2F
MAHANTANGO CREEK	Combining Field Measurements for Speciation	11 07-02504
Synoptic-Scale Assessment of Surface Runoff		International Legend for Hydrogeologica
W89-02703	to the front and buttle cycles in a buttle	Maps: Principles and Application,
MAINTENANCE	Lake,	W89-02386 71
Optimizing Operation and Maintenance of	W89-02645 5B	
Water Supply Wells,	· ·	Organization of Hydrogeological Mapping Pro
W89-02333 6	Biotechnology for Manganese Removal from	grams,
0	Groundwater,	W89-02388 71
Review of the State of the Art for Underwate	r W89-03093 5F	
Repair Using Abrasion-Resistant Concrete.		Report on Hydrogeological Maps of Karsti
W89-02781 8	Effect of pH on Iron and Manganese Uptake by	Terrains,
	a Oreen Aiga,	W89-02389 21
Upgrading Hydro Turbines: An Operating	g W89-03246 5C	
Authority's Experience,	MANNINGS EQUATION	Floodplain Mapping and Beyond: A State Per
W89-03152 8		spective,
** *** ***	Roughness Coefficients for Densely Vegetated	W89-02755 6
New Lebring Scheme Replaces the Oldest Plan		
on the Mur,	W89-02502 2E	Salt Marshes,
W89-03153 8	MANURE	W89-02762 7
Dehabilitation of the Victoria Cartie		MARC
Rehabilitation of the Kuratau Station in Ne		MAPS
Zealand,	Water Quality: The Delaware Solution,	Status of Hydrogeological Mapping in Thailan
W89-03154 8	C W89-02678 5G	W89-02384 2

Hydrogeological Mapping in the Socialist Republic of Vietnam, W89-02385 4B	Data on Groundwater Quality for the Walker Lake One Degree X Two Degree Quadrangle, Western Nevada and Eastern California,	plankton in Marine and Freshwater Environ- ments, W89-03267 2H
Data Requirements for Hydrogeological Maps,	W89-02541 7C	Comparative Ecology of the Macrofauna of
W89-02387 7A	Data on Groundwater Quality for the Tonopah One Degree X Two Degree Quadrangle, Cen-	Freshwater and Marine Muds, W89-03268 2H
Organization of Hydrogeolc rical Mapping Pro-	tral Nevada,	
grams, W89-02388 7B	W89-02542 7C	Applicability of Fish Yield Indices in Freshwater and Marine Ecosystems,
Report on Hydrogeological Maps of Karstic	Data on Groundwater Quality for the Western	W89-03270 2H
Terrains, W89-02389 2F	I wo Degree Quadrangie,	MARINE SEDIMENTS Flora and Macrofauna of Intertidal Sediments,
	W89-02543 7C	W89-02763 . 2L
Hydrogeological Mapping in Coastal Areas, W89-02390 2F	Data on Groundwater Quality for the Caliente	Macrofauna of Subtidal Sediments Using
Understallaried Many from the View Brint of	One Degree X Two Degree Quadrangle, East-	Remote Sampling,
Hydrogeological Maps from the View-Point of the User,	ern Nevada, W89-02544 7C	W89-02764 2L
W89-02391 7A		Processing Sediment Macrofauna Samples,
Selected Literature on Water Resources Investi-	Data on Groundwater Quality for the Western	W89-02765 7B
gations in New Jersey by the U.S. Geological	Nevada Part of the Death Valley One Degree X Two Degree Quadrangle,	
Survey, Through 1986,	W89-02545 7C	Sediment Transport from Delaware Bay to the New Jersey Inner Shelf,
W89-02466 10C		W89-03187 2J
Directory of Precipitation Monitoring Sites, Na-	Data on Groundwater Quality for the Southern	B. B. C. C. B. C.
tional Atmospheric Deposition Program/Na-	Nevada Part of the Kingman One Degree X Two Degree Quadrangle,	Distribution of Gamma-emitting Radionuclides in Surface Subtidal Sediments Near the Sella-
tional Trends Network (NADP/NTN).	W89-02546 7C	field Plant,
W89-02480 7A		W89-03190 5B
Potentiometric Surface of the Upper Floridan	Generalized Potentiometric Surface of the	
Aquifer in the St. Johns River Water Manage-	Sparta-Memphis Aquifer, Eastern Arkansas,	DDT Residues in Sediments from the Bay of
ment District and Vicinity, Florida, September	Spring 1980, W89-02575 7C	Bengal, W89-03198 5B
1987,	107-02373	
W89-02503 7C	Configuration and Hydrology of the Pre-Creta-	Comparison of Microbial Dynamics in Marine
Drainage Areas in the James River Basin in	ceous Rocks Underlying the Southeastern Coast-	and Freshwater Sediments: Contrasts in Anaero- bic Carbon Catabolism,
Eastern South Dakota,	al Plain Aquifer System, W89-03007 2F	W89-03257 2H
W89-02515 7C	W 67-03007	
Map Showing Groundwater Levels in Anchor-	Modelling Seasonally Freezing Ground Condi-	MARKING TECHNIQUES
age, Alaska, 1985,	tions,	New Biological Marker Layer in the Sediments of the Great Lakes: Bythothrephes cederstroemi
W89-02526 7C	W89-03331 2C	(Schodler) Spines,
Selected Water-Quality Data for the Murtaugh	MARINE BACTERIA	W89-03178 2H
Lake Area, South Central Idaho, June 1987,	Volatilization of Mercury Compounds by Meth-	A CAROLL DE LANGO
W89-02530 7C	ylmercury-Volatilizing Bacteria in Minamata	MARSH PLANTS Role of the Seed Bank in the Development of
Data on Groundwater Quality for the Millett 1	Bay Sediment,	Vegetation on a Freshwater Marsh Created
Degree X 2 Degree Quadrangle, Central	W89-03197 5B	from Dredge Spoil,
Nevada,	MARINE ENVIRONMENT	W89-03169 2H
W89-02533 7C	Fate of Crude Oil at Sea and the Natural Disper-	Response of Coastal Plants to Increase in Sub-
Data on Groundwater Quality for the Elko 1	sion of Crude Oils and Water-in-Oil Emulsions:	mergence and Salinity,
Degree X 2 Degree Quadrangle, Eastern	Results of Experiments Using a Laboratory Test	W89-03188 2L
Nevada,	Tank and Free-Floating Rings at Sea, W89-02944 5B	MANDENDO
W89-02534 7C	W 85-02544	MARSHES Responses to Acidic Deposition in Ombotrophic
Data on Groundwater Quality for the Ely 1	Temporal Variations in Dissolved and Particu-	Mires in the U.K.,
Degree X 2 Degree Quadrangle, Eastern	late Aluminum During a Spring Bloom,	W89-02314 5B
Nevada,	W89-03192 2L	Poster Continuin Page Consending Variation
W89-02535 7C	Denitrification in Freshwater and Coastal	Proton Cycling in Bogs: Geographical Variation in Northeastern North America,
Data on Groundwater Quality for the Lund 1	Marine Ecosystems: Ecological and Geochemi-	W89-02316 5B
Degree X 2 Degree Quadrangle, Eastern	cal Significance,	
Nevada,	W89-03256 2H	Role of the Seed Bank in the Development of
W89-02536 7C	Phototrophic Picoplankton: An Overview from	Vegetation on a Freshwater Marsh Created from Dredge Spoil,
Data on Groundwater Quality for the McDer-	Marine and Freshwater Ecosystems,	W89-03169 2H
mitt One Degree X Two Degree Quadrangle,	W89-03259 2H	
Northern Nevada,	Comparative Ecology of Marine and Freshwater	Fertility and Disturbance Gradients: A Summa-
W89-02537 7C	Phytoplankton,	ry Model for Riverine Marsh Vegetation, W89-03294 2H
Data on Groundwater Quality for the Lovelock	W89-03260 2H	
One Degree X Two Degree Quadrangle, West-	C	MARTINS FORK LAKE
ern Nevada,	Comparative Ecology of Submersed Grass Beds in Freshwater, Estuarine, and Marine Environ-	Martins Fork Lake Sedimentation Study: Hy-
W89-02538 7C	ments.	draulic Model Investigation, W89-02780 2J
Data on Groundwater Quality for the Winne-	W89-03264 2H	
mucca One Degree X Two Degree Quadrangle,	Production and the of Product is 35 to	MARYLAND
Central Nevada, W89-02539 7C	Production and Use of Detritus in Various Freshwater, Estuarine, and Coastal Marine Eco-	Selected Geohydrologic Characteristics of the Patapsco Aquifer at Chalk Point, Prince
W 07-02337	systems,	Georges County, Maryland,
Data on Groundwater Quality for the Reno One	W89-03266 2H	W89-02560 2F
Degree X Two Degree Quadrangle, Western		
Nevada, W89-02540 7C	Ecological Principles Affecting Community Structure and Secondary Production by Zoo-	Maryland Synoptic Stream Chemistry Survey: Estimating the Number and Distribution of
11 02-02040	Stracture and Secondary Froduction by 200-	Commission and Controlled Of

MARYLAND

Streams Affected By or At Risk from Acidifica-	General Review of Methodologies and Ap-	MEIOFAUNA
tion,	proaches in Mathematical Models for Interpreta-	Meiofauna,
W89-02846 5B	tion of Tracer Data in Hydrology, W89-03011 2F	W89-02766 2L
Superfund Record of Decision: Kane and Lom-	W89-03011	MEMBRANE FILTERS
bard, MD.	Review of Existing Mathematical Models for	Membrane Separation Processes for Industrial
W89-02977 5E	Interpretation of Tracer Data in Hydrology,	Effluent Treatment,
He of Benete Gausing to Messure Source	W89-03012 2F	W89-02806 5D
Use of Remote Gauging to Measure Sewer Invert Elevations and Head Loss,	Offline Bioregeneration of Granular Activated	A COLUMN A SID A DESIGNA
W89-03280 5D	Carbon,	MEMBRANE LINERS
11 67-03200	W89-03103 5D	Factors in Assessing the Compatibility of FMLs and Waste Liquids,
MASS SPECTROMETRY		W89-02952 5E
Chromatographic Approaches to Trace Element	Extended Period Simulation of Water Systems	W 63-02532
Speciation,	Direct Solution, W89-03106 5F	MEMBRANE PROCESSES
W89-02648 5A	W89-03106 5F	Permeable Barriers: A New Alternative for
WASS WASTING	Temperature Dependence of Liquid Film Coef-	Treatment of Contaminated Ground Waters,
Landsliding, Slope Development and Sediment	ficient for Gas Transfer,	W89-02355 5G
Yield in a Temperate Environment: Northeast	W89-03112 2K	Mambana Consession Bearing for Industrial
Romania,	Seismic Refraction Tests Above Water Table,	Membrane Separation Processes for Industrial Effluent Treatment,
W89-02897 2J	W89-03113 7A	W89-02806 5D
Palationship Patruson Soil Croom Pate and Com	710	770702000
Relationship Between Soil Creep Rate and Cer- tain Controlling Variables in a Catchment in	Hydrologic Design Methodologies for Prefeasi-	Studies of Permeation of Gases with Disinfect-
Upper Weardale, Northern England,	bility Studies of Small-Scale Hydro at Ungauged	ing Action Across Polymer Barriers,
W89-02905 2J	Sites,	W89-03044 5F
	W89-03129 7A	Mombroon Seconding Technologies for Treet
Some Relationships Between Debris Flow	Modeling of Total Nitrogen in River Using the	Membrane Separation Technologies for Treat- ment of Hazardous Wastes,
Motion and Micro-Topography for the Kamika-	Quantity-Quality Model CEQUEAU (Modelisa-	W89-03284 5D
mihori Fan, North Japan Alps,	tion de l'Azote Total en Riviere a l'Aide du	W 67-03264 3D
W89-02907 2J	Modele Quantite-Qualite CEQUEAU),	MERCURY
Precise Measurement of Microforms and Fabric	W89-03130 5B	Waste Minimization Audit Report: Case Studies
of Alluvial Cones for Prediction of Landform	Brobability and Stochastic Modelling of Water	of Minimization of Mercury-Bearing Wastes at a
Evolution,	Probability and Stochastic Modelling of Water Quality Parameters in the Thames River,	Mercury Cell Chloralkali Plant,
W89-02908 2J	W89-03135 5B	W89-02821 5E
Andreis of Stational Transport by Debaie		Volatilization of Mercury Compounds by Meth-
Analysis of Sediment Transport by Debris Flows in the Jiangjia Gully, Yunnan,	Mathematical Hydraulic Model of the River	ylmercury-Volatilizing Bacteria in Minamata
W89-02909 2J	Nene - a Canalized, and Heavily Controlled	Bay Sediment,
W 67-02-009	River,	W89-03197 5B
Dendrogeomorphic Evidence and Dating of	W89-03141 4A	
Recent Debris Flows on Mount Shasta, North-	Load-Sharing Linings: A New Design Concept	MEROMICTIC LAKES
ern California,	for Large Diameter Penstocks,	Cycling of Methane, Carbon Monoxide, Nitrous
W89-03028 2J	W89-03158 8F	Oxide, and Hydroxylamine in a Meromictic,
Magnitude and Frequency of Debris Flows, and		Coastal Lagoon,
Areas of Hazard on Mount Shasta, Northern	Predicting the Effects of a Pesticide Release to	W89-03191 2L
California,	the Rhine River, W89-03159 5C	METABOLISM
W89-03029 2J	W 69-03139	Photosynthetic Carbon Metabolism by Phyto-
	Kinetics of Low Solids Bio-denitrification of	plankton in a Nitrogen-Limited Reservoir,
MASSACHUSETTS	Water Supplies,	W89-03215 2H
Fiscal Year 1986 Program Report (Massachu-	W89-03166 5F	
setts Water Resources Research Center), W89-02587 9D	Sediment Tennenest Prediction is a Tidal Inlat	METAL COMPLEXES
W89-02387 9D	Sediment Transport Prediction in a Tidal Inlet Using a Numerical Model: Application to Stony	Thermodynamic Calculations with Special Ref-
Treatment of Farnham and Ashley Reservoir	Brook Harbor, Long Island, New York, USA,	erence to the Aqueous Aluminum System,
Water by Krofta Sandfloat Process System	W89-03185 2J	W89-02641 2K
Final Project Report,		Coordination Chemistry at the Solid/Solution
W89-02951 5F	Lagrangian-Eulerian Approach to Modeling	Interface,
MATHEMATICAL MODELS	Hydrogeochemical Transport of Multi-Compo-	W89-02642 5B
Field Measurements in a Gravel-bed River	nent Systems, W89-03320 5B	
which Confirm the Theory of White et al.,	W89-03320 5B	Comparison of Anodic Stripping Voltammetry
W89-02446 2J	MATHEMATICAL STUDIES	Speciation Data with Empirical Model Predic-
	Synoptic-Scale Assessment of Surface Runoff,	tions of pCu, W89-02646 7E
Modelling Fluvial Processes in Streams with	W89-02703 2E	W89-02646 7E
Gravel Mining,	LEC L CLIBING INCOME IN ADDITION	Measurements of Binding Site Concentrations in
W89-02462 2E	MEASURING INSTRUMENTS Measurement of Groundwater Velocity with a	Humic Substances,
Mathematical Modelling,	Colorimetric Borehole Dilution Instrument,	W89-02647 7E
W89-02725 2A	W89-02345 7B	
	12	Trace Metal Speciation in Sediments and Soils
Temperature Analysis, Howard A. Hanson Res-	Recognizing Petroleum Hydrocarbon Contami-	An Overview from a Water Industry Perspec-
ervoir, Washington: Mathematical Model Inves-	nation in the Vadose Zone with Photoionization	tive, W89-02651 5E
tigation,	Detection Scanning of Field Samples,	W 67-02031 3E
W80.07977	33/80 02261	
W89-02877 2H	W89-02351 5A	METAL-FINISHING WASTES
W89-02877 2H Groundwater Assessment Modeling Under the	W89-02351 5A Applying Electrical Resistance Blocks for Un-	8th AESF/EPA Conference on Pollution Con-
Groundwater Assessment Modeling Under the Resource Conservation and Recovery Act,		8th AESF/EPA Conference on Pollution Con- trol for the Metal Finishing Industry.
Groundwater Assessment Modeling Under the	Applying Electrical Resistance Blocks for Un-	8th AESF/EPA Conference on Pollution Con-
Groundwater Assessment Modeling Under the Resource Conservation and Recovery Act, W89-02995 5B	Applying Electrical Resistance Blocks for Unsaturated Zone Monitoring at Arid Sites, W89-02352 7B	8th AESF/EPA Conference on Pollution Control for the Metal Finishing Industry. W89-02392 50
Groundwater Assessment Modeling Under the Resource Conservation and Recovery Act,	Applying Electrical Resistance Blocks for Un- saturated Zone Monitoring at Arid Sites,	8th AESF/EPA Conference on Pollution Con- trol for the Metal Finishing Industry.

Pilot Scale Results of Metal Value Recovery from Mixed Metal Hydroxide Sludges, W89-02394 5D	Snow Cover, Cyclogenesis and Cyclone Trajectories, W89-02607 2C	Relationship of Surface Pressure Features to the Precipitation and Airflow Structure of an In- tense Midlatitude Squall Line,
Treatment of Aqueous Metal Bearing Hazardous	Relationship Between Snow Cover and Atmos-	W89-03274 2B
Wastes, W89-02396 5D	pheric Thermal and Circulation Anomalies, W89-02608 2C	Nimbus-7 Global Cloud Climatology: Part I. Algorithms and Validation,
Pollution Control Using Room Temperature Evaporators,	Relationships between Snow Cover and Tem- perature in the Lower Troposphere, General	W89-03307 2B
W89-02400 5G	Circulation in East Asia and Precipitation in China.	METHANE Cycling of Methane, Carbon Monoxide, Nitrous
Metal Finishing Wastewater Treatment Upgrade with an Insoluble Sulfide Precipitation Process,	W89-02609 2C	Oxide, and Hydroxylamine in a Meromictic, Coastal Lagoon,
W89-02402 5D	Progression of Regional Snow Melt, W89-02610 2C	W89-03191 2L
Performance of Analytical Test Kits on Metal Finishing Wastewater Samples,	Snow Cover Record in Eurasia,	Methane Cycling in the Sediments of Lake Washington,
W89-02403 5D	W89-02612 2C	W89-03249 2H
Application of Statistical Process Control to Wastewater Pretreatment,	Distribution of Snow Cover in China, W89-02613 2C	Degradation of Bromoform and Chlorodibromo- methane in a Catalyzed H2-Water System,
W89-02404 5D	Snow Surveying in Canada,	W89-03311 2K
Waste Water Reduction in Metal Fabrications	W89-02614 7B	METHANE BACTERIA
Operations, W89-02405 5D	Snow Cover in Real Time Monitoring, W89-02615 2C	Microbial, Chemical, and Technological Aspects of the Anaerobic Degradation of Organic Pollut-
Waste Treatment and Recycling of Mixed Wastewater from a Metal Finishing Company,	Northern Hemisphere Snow and Ice Chart of NOAA/NESDIS,	ants, W89-02920 5D
W89-02408 5D	W89-02616 2C	METHYLMERCURY
Waste Minimization Audit Report: Case Studies of Minimization of Solvent Wastes and Electro- plating Wastes at a DOD (Department of De-	NOAA Satellite-Derived Snow Cover Data Base: Past, Present, and Future, W89-02617 2C	Volatilization of Mercury Compounds by Meth- ylmercury-Volatilizing Bacteria in Minamata Bay Sediment,
fense) Installation, W89-02839 5D	Snow Cover Data: Status and Future Prospects,	W89-03197 5E
Superfund Record of Decision: Northern En-	W89-02618 7B	MICHIGAN
graving, WI. W89-02938 5B	Comparison of Northern Hemisphere Snow Cover Data Sets,	Groundwater Data for Michigan-1986, W89-02495 7C
METAL RECOVERY	W89-02619 7C	Effects of Gas-Pipeline Construction on the
Electrolytic Recovery Theory, Application, Ad-	Influence of Snow Structure Variability on	Aquatic Ecosystem of Canada Creek, Presque Isle County, Michigan,
vantages, W89-02407 5D	Global Snow Depth Measurement using Micro- wave Radiometry,	W89-02861 4C
Waste Treatment and Recycling of Mixed	W89-02620 7B	MICROBIAL DEGRADATION
Wastewater from a Metal Finishing Company, W89-02408 5D	Retrieval of Snow Water Equivalent from Nimbus-7 SMMR Data, W89-02621 7B	In Situ Aquifer Denitrification: Remediation o Ammonia and Nitrate Contaminated Subsurface Environments.
METALS Metal Speciation: Theory, Analysis and Applica-		W89-02359 50
tion.	Nimbus-7 SMMR Snow Cover Data, W89-02622 7C	Quantitative Studies of Biodegradation of Petro
W89-02640 5B Introduction to Interactions of Organic Com-	Snow Cover Monitoring Using Microwave Ra-	leum And Some Model Hydrocarbons in Ground Water and Sediment Environments,
pounds with Mineral Surfaces,	diometry, W89-02623 7B	W89-02674 51
W89-02643 5B Reactions and Transport of Trace Metals in	Remote Sensing of Snow Properties in Mountainous Terrain,	Groundwater Microbiology: Problems and Bio logical Treatment: State-of-the-Art Report,
Groundwater, W89-02644 5B	W89-02624 7B	W89-03075 21
Metal Speciation and Interactions among Ele-	Review of 183 GHz Moisture Profile Retrieval	Biological Degradation of Volatile Chlorinates Hydrocarbons in Groundwater,
ments Affect Trace Element Transfer in Agri-	Studies, W89-02705 7C	W89-03081 51
cultural and Environmental Food-Chains, W89-02650 5B	Nimbus-7 Global Cloud Climatology: Part I. Algorithms and Validation,	Potential of Free-Living Ground Water Bacteri to Degrade Aromatic Hydrocarbons and Heter
Transport, Bioaccumulation, and Toxicity of	W89-03307 2B	ocyclic Compounds, W89-03086 51
Metals and Metalloids in Microorganisms under Environmental Stress, W89-02652 5B	METEOROLOGICAL DATA COLLECTIONS Observation of Stratiform Rain with 94 GHz	Effect of Unsaturated/Saturated Zone Propert
Metal Treatment and Recovery, W89-02653 5D	and S-Band Doppler Radar, W89-02830 2B	Upon the Hydrogeochemical and Microbiolog cal Processes Involved in the Migration an Attenuation of Landfill Leachate Component
Temporal Variations in Dissolved and Particu-	METEOROLOGY Fiscal Year 1985 Summary Report of NOAA	W89-03087
late Aluminum During a Spring Bloom, W89-03192 2L	Meteorology Division Support to the Environ- mental Protection Agency.	MICROBIOLOGICAL STUDIES Comparison of Microbial Dynamics in Marin
METAMORPHIC ROCKS	W89-02857 5B	and Freshwater Sediments: Contrasts in Anaero
Review of Groundwater in the Republic of Korea,	Tropical and Monsoonal Studies, W89-02968 2B	bic Carbon Catabolism, W89-03257
W89-02376 2F	Rocky Mountain Acid Deposition Model As-	MICROFAUNA
METEOROLOGICAL DATA COLLECTION Snow Watch '85.	sessment: Evaluation of Mesoscale Acid Deposi- tion Models for Use in Complex Terrain,	Comparative Ecology of the Macrofauna of Freshwater and Marine Muds, W89-03268
W89-02606 2C	W89-02969 5B	W89-03268 21

2**H**

MICROORGANISMS

MICROORGANISMS	Utilization of Mine Water for Irrigation and	Sensitivity of Meander Lake to Acid Deposition,
Technologies and Costs for the Treatment of Microbial Contaminants in Potable Water Sup-	Other Uses, W89-02369 2F	W89-03110 5C
plies.	Calibration of a Dissolved Solide Model for the	MINNOW
W89-02412 5F	Calibration of a Dissolved-Solids Model for the Yampa River Basin Between Steamboat Springs and Maybell, Northwestern Colorado,	Effect of Temperature on the Chronic Toxicity of Hydrothol-191 to the Fathead Minnow (Pi-
Transport, Bioaccumulation, and Toxicity of Metals and Metalloids in Microorganisms under	W89-02591 5B	mephales promelas), W89-03206 5C
Environmental Stress,		W89-03206 5C
W89-02652 5B	MINE DRAINAGE *ACID MINE WATER	MINNOWS
	Migration of Acidic Groundwater Seepage from	Relative Abundance and Distribution of Young-
Groundwater Microbiology: Problems and Bio-	Uranium-Tailings Impoundments: 1. Field Study and Conceptual Hydrogeochemical Model,	of-the-Year Fishes and Minnows in Lake
logical Treatment: State-of-the-Art Report, W89-03075 2F	W89-03037 5B	Sharpe, South Dakota, W89-02426 2H
	MINE WASTES	
Microbial Activity in Sanitary Landfills: A Pos-	Recovery of Moisture/Solute Profiles in Re-	MIRES
sible Source of the Humic Substances in Groundwater,	claimed Coal-Mine Spoil, Northwest New	Responses to Acidic Deposition in Ombotrophic
W89-03079 5B	Mexico,	Mires in the U.K.,
	W89-02360 2F	W89-02314 5B
Ground Water: A Living Ecosystem,	Modeling Acid Migration Through Soils,	MISSISSIPPI
W89-03084 2F	W89-02361 5B	Analysis of Bank Stability in the DEC Water-
Biochemical Testing of Groundwater,		sheds, Mississippi,
W89-03085 5A	Hydrogeologic and Geochemical Aspects of	W89-02825 4D
Pid to I To the state of Company to Produce	Contaminant Transport at the Falls City, Texas UMTRA Site,	MISSISSIPPI RIVER
Biological Treatment of Groundwater in Basins	W89-02362 5B	Hurricane-Induced Sediment Deposition in a
with Floating Filters: II. The Role of Microor- ganisms in Floating Filters,		Guif Coast Marsh,
W89-03095 5G	Effects of Acid Mine Drainage on Groundwater	W89-03193 2J
	Quality at the Leviathan Sulfur Mine, Alpine	
MICROTOX	County, California, W89-02363 5C	Freshwater and Marine Coupling in Estuaries of
Microtox Assessment of Anaerobic Bacterial		the Mississippi River Deltaic Plain, W89-03271 2E
Toxicity, W89-02301 5D	Estimating the Transport and Deposition of	W 89-032/1 2E
1107-02301	Mining Waste at Ok Tedi,	MISSISSIPPI RIVER VALLEY ALLUVIAL
MIDGES	W89-02461 2J	AQUIFER
Emergence of Chironomidae (Diptera) in Fertil-	Groundwater Contamination by Nitrates and	Groundwater Levels in the Alluvial Aquifer in
ized and Natural Lakes at Saqvaqjuac, N.W.T.,	Chlorides Washed out from Phosphorite Ores in	Eastern Arkansas, 1986,
W89-03216 2H	the Negev Desert, Israel,	W89-02522 2F
Effects of Liming on the Distribution of Cadmi-	W89-03147 5B	MISSOURI
um in Water, Sediment, and Organisms in a	Fate and Effects of Xanthates in Laboratory	Water Resources Activities of the U.S. Geologi-
Swedish Lake,	Freshwater Systems,	cal Survey in Missouri, Fiscal Year 1987,
W89-03224 5B	W89-03201 5G	W89-02470 9C
Chronic Effects of Cu on Reproduction of Poly-	MINE WATER	Water Resources Activities of the U.S. Geologi-
pedilum nubifer (Chironomidae) through Water	Results of Experiments Related to Contact of	cal Survey in Missouri, Fiscal Year 1987.
and Food,	Mine-Spoils Water with Coal, West Decker and	W89-02567 9C
W89-03296 5C	Big Sky Mines, Southeastern Montana,	
Chronic Effects of Contaminated Sediment on	W89-03001 5B	Groundwater Flow System in Northern Missou-
Daphnia magna and Chironomus tentans,	MINERAL SPRINGS	ri with Emphasis on the Cambrian-Ordovician Aquifer,
W89-03312 5C	Water Resources and Hydrogeological Mapping	W89-03023 2F
MIGRATION	in the Mongolian People's Republic,	1107-03023
Contrasting Diel Patterns of Vertical Migration	W89-02379 2F	MISSOURI RIVER
in the Dinoflagellate Ceratium hirundinella in	MINERALIZATION	Limnological and Fishery Studies on Lake
Relation to Phosphorus Supply in a North Tem-	Role of Protozoa in Microbial Acclimation for	Sharpe, a Main-stem Missouri River Reservoir,
perate Reservoir,	Mineralization of Organic Chemicals in Sewage,	1964-1975,
W89-03221 2H	W89-03283 5D	W89-02423 2H
MILITARY INSTALLATIONS	MINERALS	Physical, Chemical, and Biological Characteris-
Water Quality Assessment of DOD Installa-	Introduction to Interactions of Organic Com-	tics of Lake Sharpe, South Dakota, 1966-1975,
tions/Facilities in the Chesapeake Bay Region.	pounds with Mineral Surfaces,	W89-02424 2H
Phase III Report. Volume 2 - Overall Approach,	W89-02643 5B	Zooplankton Biomass Exchange in Lake Sharpe,
Findings and Recommendations.	MINIMUM ELOW	South Dakota, 1974-1975,
W89-02954 5C	MINIMUM FLOW Case Study of Minimum Streamflow for Fishery	W89-02425 2H
Installation Restoration Program Phase II - Con-	Habitat in the Yampa River,	
firmation/Quantification. Stage I.	W89-02460 2J	Relative Abundance and Distribution of Young-
W89-02999 5B	MANUAL PROPERTY.	of-the-Year Fishes and Minnows in Lake Sharpe, South Dakota,
MILK RIVER	MINING EFFECTS Recovery of Moisture/Solute Profiles in Re-	W89-02426 2H
Natural Flow and Water Consumption in the	claimed Coal-Mine Spoil, Northwest New	
Milk River Basin, Montana and Alberta, Canada,	Mexico,	Biology of the Walleye in Lake Sharpe, South
W89-03004 2E	W89-02360 2F	Dakota, 1964-1975,
MIMBRES BASIN	Modelling Fluvial Processes in Streams with	W89-02427 2H
Use of a Regional Ground-Water Flow Model	Gravel Mining,	Early Life History and Winter Mortality of Giz-
for Water Rights Administration in a Southwest	W89-02462 2E	zard Shad in Lake Sharpe, South Dakota,
Alluvial Basin,		W89-02429 2H
W89-02332 4B	MINNESOTA Water Quality Date for Oswall Reservoir and	MISSOURI RIVERS
MINE DRAINAGE	Water Quality Data for Orwell Reservoir and the Otter Tail River Near Fergus Falls, Minne-	Biology of the Yellow Perch in Lake Sharpe,
Water-Bearing Zones in the Mining Area of the	sota,	South Dakota, 1964-1975,
Northern Region of Bangladesh with Regard to	W89-02605 5B	W89-02428 2H

MIXING Dynamics of Partially Mixed Estuaries,	Time-Varying Stochastic Model of the Frequen- cy and Magnitude of Bed Load Transport	North Alabama Water Quality Assessment, Volume VIII - Water Quality Modeling,
W89-02683 2L	Events in Two Small Trout Streams,	W89-02702 5B
Dispersion in Shallow Estuaries, W89-02685 2L	W89-02459 2J Modelling Fluvial Processes in Streams with	Mathematical Modelling, W89-02725 2A
	Gravel Mining,	
Tidally Generated Estuarine Mixing Processes, W89-02686 2L	W89-02462 2E	Formulas for Velocity, Sediment Concentration and Suspended Sediment Flux for Steady Uni- Directional Pressure-Driven Flow.
Estuarine Fronts.	Proceedings, Seventeenth Mississippi Water Re- sources Conference, 25-26 March, 1987, Jackson,	W89-02779 23
W89-02689 2L	Mississippi.	
Puget Sound: A Fjord System Homogenized	W89-02476 6B	Processes, Coefficients, and Models for Simulat-
with Water Recycled over Sills by Tidal Mixing,	Comparison of Conceptually Based and Regres-	ing Toxic Organics and Heavy Metals in Surface Waters.
W89-02694 2L	sion Rainfall-Runoff Models, Denver Metropoli-	W89-02788 5B
Physical Oceanography of the St. Lawrence Es-	tan Area, Colorado, and Potential Applications in Urban Areas,	Modeling the Effects of Adsorbed Hydrolyzed
tuary,	W89-02483 4C	Al(III)-Ions on Deep Bed Filtration,
W89-02698 2L	Dogumentation for a Digital Commuter Model	W89-02796 5F
Djinnang II: A Facility to Study Mixing in	Documentation for a Digital Computer Model of Nutrient and Dissolved-Oxygen Transport in	Fiscal Year 1985 Summary Report of NOAA
Stratified Waters, W89-02701 7B	the Truckee River and Truckee Canal Down-	Meteorology Division Support to the Environ-
W89-02/01 /B	stream from Reno, Nevada,	mental Protection Agency. W89-02857 5B
MOBILE BAY	W89-02504 5B	
Mobile Bay Estuary: Stratification, Oxygen De- pletion, and Jubilees,	Techniques for Estimating Regional Flood	New Haven Harbor Numerical Model Study, W89-02874 6G
W89-02696 2L	Characteristics of Small Rural Watersheds in the	W89-02874 6G
	Plains Region of Eastern Colorado, W89-02507 2E	Controls on Overland Flow Generation,
MODEL STUDIES Use of a Regional Ground-Water Flow Model		W89-02882 2E
for Water Rights Administration in a Southwest	Groundwater Flow in the Navajo Sandstone in	Hydrochemical Characteristics of a Dartmoor
Alluvial Basin,	Parts of Emery, Grand, Carbon, Wayne, Gar- field, and Kane Counties, Southeast Utah,	Hillslope,
W89-02332 4B	W89-02521 2F	W89-02903 2E
Optimizing Operation and Maintenance of	The Civil of Market of the Tital Dates	Critique of Models for Freshwater and Soil
Water Supply Wells,	Flow Simulation Model of the Tidal Potomac River.	Acidification,
W89-02333 6B	W89-02529 2L	W89-02967 SE
Transition from Ground-Water Mining to In-	Water to the total and the No. Co. of Paris	Rocky Mountain Acid Deposition Model As-
duced Recharge in Generalized Hydrogeologic	Hydrologic Analysis of the Rio Grande Basin North of Embudo, New Mexico, Colorado and	sessment: Evaluation of Mesoscale Acid Deposi-
Systems, W89-02337 4B	New Mexico,	tion Models for Use in Complex Terrain, W89-02969 5E
W89-02337 4B	W89-02589 2F	
Simulating Underground Mines in a Regional	Calibration of a Dissolved-Solids Model for the	Role of Tracer Data for Modeling Soil-Water Flow in the Unsaturated Zone,
Model, W89-02339 4C	Yampa River Basin Between Steamboat Springs	W89-03013 2G
	and Maybell, Northwestern Colorado, W89-02591 5B	Construction Plant Control in Northern Minner
Quantity and Quality of Recharge to the Ogal-	W89-02391 3B	Groundwater Flow System in Northern Missou ri with Emphasis on the Cambrian-Ordovician
lala Aquifer from Urban Runoff, W89-02340 4C	Analytically-Derived Sensitivities in One-Di-	Aquifer,
	mensional Models of Solute Transport in Porous Media,	W89-03023 2F
Modeling the Response of Lake-Aquifer Sys- tems to Acid Precipitation,	W89-02595 5B	Hydrology, Geomorphology, and Dam-Breal
W89-02341 5C		Modeling of the July 15, 1982, Lawn Lake Dan
	Computer-Program Documentation of an Inter- active-Accounting Model to Simulate Stream-	and Cascade Lake Dam Failures, Larime
Field Simulation of Waste Impoundment Seep- age in the Vadose Zone,	flow, Water Quality, and Water-Supply Oper-	County, Colorado, W89-03027 8A
W89-02348 5B	ations in a River Basin,	
Madellan of Balada data Bisharda b	W89-02600 7C	Migration of Acidic Groundwater Seepage from Uranium-Tailings Impoundments: 1. Field Study
Modeling of Polychlorinated Biphenyls in Vadose Zone,	Snow Cover, Cyclogenesis and Cyclone Trajec-	and Conceptual Hydrogeochemical Model,
W89-02353 5B	tories,	W89-03037 51
Madeline Asid Missels Thomas Sails	W89-02607 2C	Migration of Acidic Groundwater Seepage from
Modeling Acid Migration Through Soils, W89-02361 5B	Soot from Arctic Haze: Radiative Effects on the	Uranium-Tailings Impoundments: 2. Geochemi
	Arctic Snowpack,	cal Behavior of Radionuclides in Groundwater
Hydrogeologic and Geochemical Aspects of Contaminant Transport at the Falls City, Texas	W89-02611 2C	W89-03038 51
UMTRA Site,	Modelling a Seasonal Snow Cover,	Migration of Acidic Groundwater Seepage from
W89-02362 5B	W89-02627 2C	Uranium-Tailings Impoundments: 3. Simulation
Conceptual Models of Sediment Transport in	Characteristics of Seasonal Snow Cover as Sim-	of the Conceptual Model with Application to Seepage Area A,
Streams,	ulated by GFDL Climate Models,	W89-03039 51
W89-02443 2J	W89-02628 2C	
Investigation of Sediment Routing by Size Frac-	Interactive Simulation of Chemical Movement	Stochastic Modelling of Rainfall Occurrences i Continuous Time,
tions in a Gravel-Bed River,	in Soil,	W89-03049 2
W89-02444 2J	W89-02675 5B	Vulnerability Study of the Aubergenville Aqu
Sediment Transport in Step-Pool Streams,	Modeling of Tidally Induced Residual Currents,	fer,
W89-02448 2J	W89-02690 2L	W89-03077 5
Problems of Bed Load Transport in Braided	Eulerian and Lagrangian Modeling of Estuarine	Biodegradation Modeling at Aviation Fuel Spi
Gravel-Bed Rivers,	Hydrodynamics,	Site,
W89-02455 2J	W89-02691 2L	W89-03100 5

MODEL STUDIES

Leachate Collection in Landfills: Steady Case, W89-03102 5E	MONITORING New Approaches to Monitoring Aquatic Eco-	Monitoring and Surveillance, W89-02991 7B
Model Calibration Based on Random Environ-	systems. W89-02317 5A	Analysis of Biomonitoring Techniques to Sup-
mental Fluctuations, W89-03105 7A	Monitoring the Nation's WatersA New Per-	plement Effluent Guidelines.
	spective,	W89-02994 5A
Extended Period Simulation of Water Systems Direct Solution, W89-03106 5F	W89-02318 5A Strategies for Long-Term Pollution Monitoring	Critical Assessment of the 'Dynamic Daphnia Test' (Kritische Betrachtung des 'Dynamischen
Experimental Study of Flow in Settling Tanks,	of the Coastal Oceans,	Daphnien Tests'), W89-03046 5A
W89-03107 8B	W89-02319 5A	
Sensitivity of Meander Lake to Acid Deposition, W89-03110 5C	Innovative Designs for Water Quality Monitor- ing: Are We Asking the Questions Before the Data Are Collected,	Utility of Soluble Reactive Phosphorus Meas- urements in Great Lakes Surveillance Programs: A Summary,
Modeling of Total Nitrogen in River Using the	W89-02320 7A	W89-03180 5A
Quantity-Quality Model CEQUEAU (Modelisation de l'Azote Total en Riviere a l'Aide du Modele Quantite-Qualite CEQUEAU), W89-03130 5B	Comparison of Lake Sediments and Ombrotro- phic Peat Deposits as Long-Term Monitors of Atmospheric Pollution,	Estuaries: Concern Over Troubled Waters, W89-03279 7A
	W89-02321 5A	Comparison of Flow-Through and Towed
Mathematical Hydraulic Model of the River Nene a Canalized, and Heavily Controlled	Review of the Crater Lake Limnological Pro- grams,	Fluorometers for Measuring Oil Concentrations in the Sea,
River,	W89-02322 2H	W89-03329 5A
W89-03141 4A	Monitoring, Research, and Management: Inte-	MONITORING WELLS
Simulations of Physical Nonequilibrium Solute	gration for Decisionmaking in Coastal Marine	Design and Construction of a Subsurface Gaso-
Transport Models: Application to a Large-Scale Field Experiment,	Environments, W89-02323 5A	line Recovery System Westminster, Colorado, W89-02357 5G
W89-03148 2F		W 89-02337
Sensitivity Analysis of Adsorption and Degrada-	Multidecade Trend-Monitoring Program for Chesapeake Bay, A Temperate East Coast Estu-	Rationale for the Design of Monitoring Well
tion Parameters in the Modeling of Pesticide	ary,	Screens and Filter Packs, W89-03332 5B
Transport in Soils, W89-03150 2G	W89-02324 7A	
	Coastal Monitoring: Evaluation of Monitoring	MONSOONS
Solute Transport Modeling in Heterogeneous Soils: Conjunctive Application of Physically	Methods in Narragansett Bay, Long Island Sound and New York Bight, and a General	Tropical and Monsoonal Studies, W89-02968 2B
Based and System Approaches,	Monitoring Strategy,	F C 10 - 1F C
W89-03151 2G	W89-02325 5A	Eurasian Snow Cover and Seasonal Forecast of Indian Summer Monsoon Rainfall,
Kinetics of Low Solids Bio-denitrification of	'Mussel Watch'Measurements of Chemical Pol-	W89-03054 2B
Water Supplies, W89-03166 5F	lutants in Bivalves as One Indicator of Coastal Environmental Quality,	MONTANA
	W89-02326 5A	Effects of Geology, Runoff, and Land Use on
Pu(239,240) Residence Times in Freshwaters and Accumulation in Shield Lake Sediments, W89-03209 2H	Estuarine Invertebrates and Fish: Sampling Design and Constraints for Long-Term Meas-	the Stability of the West Gallatin River System, Gallatin County, Montana,
	urements of Population Dynamics,	W89-02472 4C
Comparative Ecology of Marine and Freshwater Phytoplankton,	W89-02327 2L	Supplemental Arsenic Data for Selected Streams
W89-03260 2H	Development, Management, and Analysis of a Long-Term Ecological Research Information	in the Missouri River Basin, Montana, 1987, W89-02516 5B
Estimate of Precipitation Enhancement Potential for the Duero Basin of Spain,	Base: Example for Marine Macrobenthos, W89-02329 10D	Evapotranspiration Rates at Selected Sites in the
W89-03306 3B		Powder River Basin, Wyoming and Montana,
Influence of Potential Evaporation on the Varia-	Monitoring and Quality Assurance Procedures for the Study of Remote Watershed Ecosystems,	W89-02524 2D
bilities of Simulated Soil Wetness and Climate,	W89-02330 5A	Selected Hydrogeologic Data for the Southwest
W89-03308 2D	Assessment of the Adequacy of the Ground-	Glendive Preliminary Logical Mining Unit and
Modeling Groundwater Transport of Dissolved Gasoline and Using the Results to Evaluate Aq-	Water Monitoring System for Artificial Re- charge of Aquifers in the Los Angeles Area,	Adjacent Areas, Dawson County, Montana, W89-02531 7C
uifer Restoration Processes,	California,	
W89-03321 5B		Water Quality Data (July 1986 Through Sep- tember 1987) and Statistical Summaries (March
Flood Inundation Modelling Using MILHY, W89-03330 2E		1985 Through September 1987) for the Clark Fork and Selected Tributaries from Deer Lodge
Modelling Seasonally Freezing Ground Condi-	W89-02490 7A	to Missoula, Montana,
tions,	Pesticide and Synthetic Organic Compound	W89-02566 5B
W89-03331 2C	Survey: Report to the Iowa General Assembly on the Results of the Water System Monitoring	Results of Experiments Related to Contact of
Model for Predicting the Effect of Drainage on Soil Moisture, Soil Temperature and Crop Yield,	Required by House File 2303.	Mine-Spoils Water with Coal, West Decker and Big Sky Mines, Southeastern Montana,
W89-03334 4A		W89-03001 5B
MODELS Pole of Pineries Woods in Pagulating Nitroper	Lake Michigan Water Quality Report January through December, 1986.	Natural Flow and Water Consumption in the
Role of Riparian Woods in Regulating Nitroger Fluxes Between the Alluvial Aquifer and Sur-		Milk River Basin, Montana and Alberta, Canada, W89-03004 2E
face Water: A Conceptual Model,	Volunteer Lake Monitoring Program, 1987.	
W89-03140 6G	Volume I: Statewide Summary Report, W89-02869 7B	Regional Aquifer System Underlying the North- ern Great Plains in Parts of Montana, North
MONGOLIA Water Resources and Hydrogeological Mapping		Dakota, South Dakota, and Wyoming: Summa-
in the Mongolian People's Republic,	termination (APHA/AWWA/ WPCF Method),	ry, W80.03033
W89-02379 21		W89-03033 2F

MONTE CARLO METHOD Consideration of Dimensional Dependence in	Hydrogen Sulphide Control in Municipal Sewers,	Monitoring the Nation's Waters-A New Per-
Modelling the Structure of Flow Zones within	W89-02810 5D	spective,
the Subsurface, W89-02551 5B	Chemically Supported Oil and Grease Removal	W89-02318 5A
MONTICELLO DAM	in Municipal Wastewater Treatment Plants, W89-02813 5D	NATURAL GAS
Dynamic Reservoir Interaction with Monticello	W 69-02613	Effects on Suspended and Substrate Sediments
Dam,	Use and Disposal of Municipal Wastewater	in Two Streams Resulting from Different Gas- Pipeline Installation Techniques,
W89-02848 8A	Sludge. W89-02834 5E	W89-02823 4C
MORBIDITY Physiological Disturbances in Fish Living in	Composting of Municipal Wastewater Sludges.	Effects of Gas-Pipeline Construction on the
Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents,	W89-02855 5D	Aquatic Ecosystem of Canada Creek, Presque Isle County, Michigan, W89-02861 4C
W89-03234 5C	Municipal Wastewater Sludge Combustion Technology.	W89-02861 4C
MORTALITY	W89-02872 5D	NATURAL WATERS
Early Life History and Winter Mortality of Giz-	Development of an Innovative and Cost-Effec-	Acidification of Freshwaters, W89-02774 5B
zard Shad in Lake Sharpe, South Dakota, W89-02429 2H	tive Municipal-Industrial Waste Treatment	W89-02774 5B
W89-02429 2H	System,	Organic Chemicals in Natural Waters: Applied
MORTAR	W89-02960 5D	Monitoring and Impact Assessment, W89-02776 5C
Sulfate Resistance of Mortars Made Using Port- land Cement and Blends of Portland Cement and	Belt Filter Press Dewatering of Wastewater	W69-02/16
Pozzolan or Slag,	Sludge.	NEARSHORE PROCESSES
W89-02714 8F	W89-03099 5D	Nearshore Transport Processes Affecting the Dilution and Fate of Energy-Related Contami-
MOSQUITOES	Municipal Wastewater Treatment Technology	nants,
Engineering, Mosquitoes and Filariasis: A Case	Transfer Activities of the United States Environ- mental Protection Agency,	W89-02843 5B
Report, W89-03065 5G	W89-03325 5D	Nearshore Transport Processes Affecting the
W 69-03063		Dilution and Fate of Energy-Related Contami-
Indirect Effects and Biological Control of Mos-	MUNICIPAL WASTEWATER TREATMENT It's Your Choice: A Guidebook for Local Offi-	nants,
quitoes by Mosquitofish, W89-03124 2H	cials on Small Community Wastewater Manage-	W89-02972 5B
	ment Options.	NEBRASKA
MOUNTAINS Cumulus and Thunderstorm Initiation by Moun-	W89-02838 5D	Summary of the High Plains Regional Aquifer-
tains,	MUNICIPAL WATER	System Analysis in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South
W89-02787 2B	West in Profile, W89-02631 6D	Dakota, Texas, and Wyoming,
Dendrogeomorphic Evidence and Dating of		W89-03030 2F
Recent Debris Flows on Mount Shasta, North- ern California, W89-03028 2J	Toward Sustaining a Desert Metropolis: Water and Land Use in Tucson, Arizona, W89-02637 6D	Effects of Future Ground-Water Pumpage of the High Plains Aquifer in Parts of Colorado Kansas, Nebraska, New Mexico, Oklahoma
Magnitude and Fraguesou of Dobric Flours and	Water Management Issues in the Denver, Colo-	South Dakota, Texas, and Wyoming,
Magnitude and Frequency of Debris Flows, and Areas of Hazard on Mount Shasta, Northern	rado, Urban Area, W89-02638 6D	W89-03031 2F
California, W89-03029 2J		NEMATICIDES
	Sewage Hardness and Mortality from Cancer and Cardiovascular Disease,	Movement of Carbofuran (Nematicide) in Soi Columns,
MT. ST. HELENS Hydrologic Data for Computation of Sediment	W89-03309 5D	W89-03297 51
Discharge, Toutle and North Fork Toutle		
Rivers near Mount St. Helens, Washington,	MUSSELS 'Mussel Watch'Measurements of Chemical Pol-	NEPAL
1980-84. W89-02571 7C	lutants in Bivalves as One Indicator of Coastal Environmental Quality,	Hydrogeology of the Butwal-Bhairahwa Area Lumbini Zone, Nepal,
MUD	W89-02326 5A	W89-02380 21
Comparative Ecology of the Macrofauna of	MUTAGENICITY	NERITIC ENVIRONMENT
Freshwater and Marine Muds, W89-03268 2H	In Vitro Genotoxicity of Chlorinated Drinking	Macrofauna of Subtidal Sediments Using Remote Sampling,
W 89-03288 2H	Water Processed from Humus-Rich Surface	W89-02764 21
MUD FLOWS	Water, W89-03202 5C	
Influence of Large Suspended-Sediment Con- centrations in Rivers,	W 89-03202	Subtidal Rock and Shallow Sediments Usin Diving,
W89-02451 2J	MYCOBACTERIUM	W89-02768
MUNICIPAL WASTES	Concentration of Mycobacterium avium by Hos- pital Hot Water Systems,	
Evaluation of Municipal Solid Waste Landfill	W89-03304 5B	NERVOUS SYSTEM In Vivo and In Vitro Effect of Triclorfon of
Cover Designs, W89-02871 5E	MYSIDS	Esterases of the Red Crayfish Procambarus cla
W89-02871 5E	Acute Toxicity of Malathion, Tetrabromobis-	kii,
MUNICIPAL WASTEWATER	phenol-A, and Tributyltin Chloride to Mysids	W89-03314 5
Fate of 4,6-Dinitro-o-Cresol in Municipal Acti- vated Sludge Systems,	(Mysidopsis bahia) of Three Ages, W89-03203 5C	NETWORK DESIGN
W89-02296 5D		Innovative Designs for Water Quality Monito
Partitioning of Toxic Organic Company to	NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM	ing: Are We Asking the Questions Before the Data Are Collected.
Partitioning of Toxic Organic Compounds on Municipal Wastewater Treatment Plant Solids,	NAPAP Operating Research Plan: 1986-1988.	W89-02320 7.
W89-02299 5D	W89-02876 5B	Assessment of the Adequacy of the Ground
Economic And Environmental Impacts of Using	NATIONAL CONTINGENCY PLAN	Water Monitoring System for Artificial R
Municipal Sewage Effluent for Agricultural Production,	Liability for Managing Hazardous Wastes: Past, Present and Future,	charge of Aquifers in the Los Angeles Are California.
W89-02663 5E	W89-02398 6E	

NETWORK DESIGN

Statewide Groundwater Quality Monitoring Network Design, W89-02343 5A	Data on Groundwater Quality for the Western Nevada Part of the Goldfield One Degree X Two Degree Quadrangle,	Hydrologic Analysis of the Rio Grande Basin North of Embudo, New Mexico, Colorado and New Mexico,
Design of a Great Lakes Atmospheric Inputs	W89-02543 7C	W89-02589 2F
and Sources (GLAIS) Network, W89-02418 7A	Data on Groundwater Quality for the Caliente One Degree X Two Degree Quadrangle, East-	Seasonal Changes in Groundwater Levels in the Shallow Aquifers Near Hagerman and the Pecos River, Chaves County, New Mexico,
Bed Load Sampling and Analysis, W89-02434 2J	ern Nevada, W89-02544 7C	W89-02601 4B
National Surface Water Survey: National Stream Survey Phase I - Pilot Survey, W89-02842 5G	Data on Groundwater Quality for the Western Nevada Part of the Death Valley One Degree X Two Degree Quadrangle,	Summary of the High Plains Regional Aquifer- System Analysis in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South
Design of the Primary Pre-TRMM and TRMM	W89-02545 7C	Dakota, Texas, and Wyoming, W89-03030 2F
Ground Truth Site, W89-02971 7A	Data on Groundwater Quality for the Southern Nevada Part of the Kingman One Degree X	Effects of Future Ground-Water Pumpage on the High Plains Aquifer in Parts of Colorado,
Nonparametric Evaluation of the Size of Limno- logical Sampling Networks: Application to the	Two Degree Quadrangle, W89-02546 7C	Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming,
Design of a Survey of Green Bay, W89-03174 7A	Geophysical Logs and Hydrological Data for Eight Wells in the Coyote Spring Valley Area,	W89-03031 2F
ETWORKS	Clark and Lincoln Counties, Nevada,	NEW YORK
Water Resources Activities of the U.S. Geologi-	W89-02603 4B	Fiscal Year 1986 Program Report (New York Water Resources Institute),
cal Survey in Missouri, Fiscal Year 1987, W89-02470 9C	NEVADA TEST SITE	W89-02471 9D
	Vegetation and Climates of the Last 45,000	Aquatic Macrophytes in Adirondack (New
Methods for Hydrologic Monitoring of Surface Mining in the Central-Western United States,	Years in the Vicinity of the Nevada Test Site, South-Central Nevada,	York) Lakes: Patterns of Species Composition in Relation to Environment,
W89-02490 7A	W89-03024 7C	W89-03056 5C
EVADA	NEW HAVEN HARBOR	Sediment Transport Prediction in a Tidal Inlet
Documentation for a Digital Computer Model	New Haven Harbor Numerical Model Study,	Using a Numerical Model: Application to Stony
of Nutrient and Dissolved-Oxygen Transport in the Truckee River and Truckee Canal Down-	W89-02874 6G	Brook Harbor, Long Island, New York, USA, W89-03185 2J
stream from Reno, Nevada,	NEW JERSEY	W 69-03183
W89-02504 5B	Selected Literature on Water Resources Investi- gations in New Jersey by the U.S. Geological	NEW ZEALAND Rapid Subsurface Flow and Streamflow Solute
Data on Groundwater Quality for the Millett 1 Degree X 2 Degree Quadrangle, Central	Survey, Through 1986,	Losses in a Mixed Evergreen Forest, New Zea-
Nevada,	W89-02466 10C	land,
W89-02533 7C	Rainfall-Runoff Data for Somerset County, New	W89-02890 2G
Data on Groundwater Quality for the Elko 1 Degree X 2 Degree Quadrangle, Eastern	Jersey, W89-02592 2E	Rehabilitation of the Kuratau Station in New Zealand.
Nevada,	Regulation of the Agricultural Utilization of	W89-03154 8C
W89-02534 7C	Sewage Sludge in New Jersey,	NIAGARA RIVER
Data on Groundwater Quality for the Ely 1	W89-02676 5E	Results of a Short-Term Toxicity Study for
Degree X 2 Degree Quadrangle, Eastern Nevada, W89-02535 7C	Superfund Record of Decision: Rockaway Bor- ough Well Field, NJ.	Three Organic Chemicals Found in Niagara River Drinking Water, W89-03310 5C
	W89-02706 5D	W 65-03310
Data on Groundwater Quality for the Lund 1 Degree X 2 Degree Quadrangle, Eastern	Characteristics of the Sorption of Chlorothalonil	NIGERIA Groundwater Occurrence and Flow Pattern in
Nevada, W89-02536 7C	and Azinphos-Methyl to a Soil from a Commer- cial Cranberry Bog,	the Enugu Coal-Mine Area, Anambra State, Ni-
	W89-03195 5B	geria, W89-03051 2F
Data on Groundwater Quality for the McDer- mitt One Degree X Two Degree Quadrangle,	NEW MEXICO	NAMES A PROPERTY.
Northern Nevada,	Use of a Regional Ground-Water Flow Model	NITRATES In Situ Aquifer Denitrification: Remediation of
W89-02537 7C	for Water Rights Administration in a Southwest Alluvial Basin,	Ammonia and Nitrate Contaminated Subsurface
Data on Groundwater Quality for the Lovelock One Degree X Two Degree Quadrangle, West-	W89-02332 4B	Environments, W89-02359 5G
ern Nevada, W89-02538 7C	Field Study of Ephemeral Stream-Aquifer Interaction,	Agricultural Impact on Groundwater Quality
Data on Groundwater Quality for the Winne-	W89-02349 2F	W89-02549 5E
mucca One Degree X Two Degree Quadrangle,	Use of Saline Water for Buffalo Gourd Produc-	Nitrates and Pesticides in Ground Water: An Analysis of a Computer-Based Literature
Central Nevada, W89-02539 7C	tion in New Mexico, W89-02475 3C	Search,
Data on Groundwater Quality for the Reno One		W89-02666 5E
Degree X Two Degree Quadrangle, Western Nevada,	Hydrology of Area 62, Northern Great Plains and Rocky Mountain Coal Provinces-New	Investigation of Nitrate Contamination in Shal low Ground Waters Near Woodward, Oklaho
W89-02540 7C	Mexico and Arizona, W89-02498 2F	ma,
Data on Groundwater Quality for the Walker		W89-02671 51
Lake One Degree X Two Degree Quadrangle, Western Nevada and Eastern California,	Description of Piezometer Nests and Water Levels in the Rio Grande Valley Near Albu-	Studies of the Mechanisms and Rates wit which Nitrogen Species are Incorporated int
W89-02541 7C	querque, Bernalillo County, New Mexico,	Cloud Water and Precipitation,
Data on Groundwater Quality for the Tonopah	W89-02509 2F	W89-02862 51
One Degree X Two Degree Quadrangle, Cen-	Hydrogeology of the Socorro and La Jencia	In Situ Biological Groundwater Denitrification
tral Nevada, W89-02542 7C	Basins, Socorro County, New Mexico, W89-02517 2F	Concepts and Preliminary Field Tests, W89-03097 50
	11 07-04311 2F	W89-03097 50

Problems in Czechoslovakia Regarding Methods of Removal of Nitrates from Drinking Water, W89-03098 5D	Toxicity of Six Heterocyclic Nitrogen Compounds to Daphnia pulex, W89-03315 5C	Report and Draft Environmental Impact State- ment. W89-02937
W 89-03098		W89-02937 8A
Contaminated Aquifers are a Forgotten Component of the Global N2O Budget, W89-03121 5B	NITROGEN CYCLE Efficient Nitrogen Fertilization in Agricultural Production Systems,	Hydrogeochemistry of the Upper Part of the Fort Union Group in the Gascoyne Lignite Strip-Mining Area, North Dakota,
	W89-02665 5B	W89-03026 4C
Groundwater Contamination by Nitrates and Chlorides Washed out from Phosphorite Ores in the Negev Desert, Israel, W89-03147 5B	Cycling of Methane, Carbon Monoxide, Nitrous Oxide, and Hydroxylamine in a Meromictic, Coastal Lagoon,	Regional Aquifer System Underlying the North- ern Great Plains in Parts of Montana, North
W89-03147 3B	W89-03191 2L	Dakota, South Dakota, and Wyoming: Summa- ry,
Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples,	NITROGEN FIXATION Nitrogen Fixation in Freshwater, Estuarine, and	W89-03033 2F
W89-03302 5A	Marine Ecosystems: 1. Rates and Importance, W89-03254 2H	Hydrology and Chemistry of Selected Prairie Wetlands in the Cottonwood Lake Area, Stuts- man County, North Dakota, 1979-82,
NITRIC ACID Studies of the Mechanisms and Rates with	Nitrogen Fixation in Freshwater, Estuarine, and	W89-03035 2H
which Nitrogen Species are Incorporated into	Marine Ecosystems: 2. Biogeochemical Con- trols,	NORWAY
Cloud Water and Precipitation, W89-02862 5B	W89-03255 2H	Treatment of Oil and Oily Wastes,
	NITROGEN-FIXING BACTERIA	W89-02963 5G
NITRIFICATION Respiration-Based Evaluation of Nitrification In-	Nitrogen Fixation in Freshwater, Estuarine, and Marine Ecosystems: 2. Biogeochemical Con-	NUISANCE ALGAE Nuisance Phytoplankton Blooms in Coastal, Es-
hibition Using Enriched Nitrosomonas Cultures, W89-02302 7B	trols, W89-03255 2H	tuarine, and Inland Waters, W89-03262 2H
Influence of Sludge from Chemical Biological	NITROGEN REMOVAL	
Wastewater Treatment on Nitrification and Di-	Utilization of Nitrite Oxidation Inhibition to Im-	NUMERICAL ANALYSIS New Haven Harbor Numerical Model Study,
gestion, W89-02816 5D	prove the Nitrogen Elimination Process, W89-02288 5D	W89-02874 6G
		NUTRIENT REMOVAL
NITRITES Utilization of Nitrite Oxidation Inhibition to Im-	Pre-Precipitation for Improvement of Nitrogen Removal in Biological Wastewater Treatment,	Enhanced Secondary Treatment Incorporating
prove the Nitrogen Elimination Process,	W89-02812 5D	Biological Nutrient Removal,
W89-02288 5D	NITROGUANIDINE	W89-03163 5D
NITROCELLULOSE Engineering/Cost Evaluation of Options for Removal/Disposal of NC Fines,	Land Treatment of Nitroguanidine Wastewater, W89-02293 5D	NUTRIENT TRANSPORT Kinetic Control of Dissolved Phosphate in Natural Rivers and Estuaries: A Primer on the Phos-
W89-02933 5D	NONPOINT POLLUTION SOURCES Analysis of Agricultural Nonpoint Pollution	phate Buffer Mechanism, W89-03253 2K
NITROGEN Soil Testing As a Guide to Prudent Use of	Control Options in the St. Albans Bay Water- shed,	
Nitrogen Fertilizers in Oklahoma Agriculture,	W89-02419 5G	NUTRIENTS Development of Estimation Methods for Tribu-
W89-02664 7B	NONPOINT POLUTION SOURCES Estuaries: Concern Over Troubled Waters,	tary Loading Rates of Toxic Chemicals, W89-02547 5B
Nitrogen and Ground Water Protection. W89-02679 5G	W89-03279 7A	
Modeling of Total Nitrogen in River Using the	NONSTRUCTURAL ALTERNATIVES	Managing Farm Nutrients: Tradeoffs for Sur- face- and Ground-Water Quality,
Quantity-Quality Model CEQUEAU (Modelisa- tion de l'Azote Total en Riviere a l'Aide du	Conflicting Objectives in Floodplain Manage- ment: Flood Damage Reduction Versus Herit- age Preservation,	W89-02833 5G Effects of Ozone and Acid Rain on White Pine
Modele Quantite-Qualite CEQUEAU), W89-03130 5B	W89-02749 6F	(Pinus strobus) Seedlings Grown in Five Soils: III. Nutrient Relations,
Role of Riparian Woods in Regulating Nitrogen	NORRIS DAM	W89-03058 5C
Fluxes Between the Alluvial Aquifer and Sur-	Effects of Aeration and Minimum Flow En- hancement on the Biota of Norris Tailwater,	Change in Distribution Patterns of Photosynthe-
face Water: A Conceptual Model, W89-03140 6G	W89-02826 5G	tically Incorporated C during Phytoplankton
	NORTH AMERICA	Bloom in Controlled Experimental Ecosystem, W89-03059 2L
Dynamics of Lake Michigan Phytoplankton: Re- lationship to Nitrogen and Silica Fluxes,	Acid Precipitation in North America: 1985	
W89-03230 2H	Annual and Seasonal Data Summaries from Acid Deposition System Data Base,	Temporal Variations in Dissolved and Particu- late Aluminum During a Spring Bloom,
NITROGEN BACTERIA	W89-02997 5B	W89-03192 2L
Respiration-Based Evaluation of Nitrification In- hibition Using Enriched Nitrosomonas Cultures, W89-02302 7B	NORTH CAROLINA Advisory System for North Carolina Ground- water Quality Modeling and Management	Influence of Nutrient Enrichment and Light Availability on the Abundance of Aquatic Ma-
NITROGEN COMPOUNDS	Needs,	crophytes in Florida Streams, W89-03231 5C
Selected Water-Quality Data for the Murtaugh		Production and Use of Detritus in Various
Lake Area, South Central Idaho, June 1987, W89-02530 7C	na Water Resources Research Institute).	Freshwater, Estuarine, and Coastal Marine Eco- systems,
Studies of the Mechanisms and Rates with	W89-02554 9D	W89-03266 2H
which Nitrogen Species are Incorporated into	NORTH DAKOTA	SPREX Hydrographic Data Report, Volume 3
Cloud Water and Precipitation, W89-02862 5B		- Chlorophyll and Nutrients, W89-03323 2L
Biodegradation of Nitrogen- and Oxygen-Con-		
taining Aromatic Compounds in Groundwater from an Oil-Contaminated Aquifer,	Souris River Basin Project, Saskatchewan,	BOD and Nutrient Removal by Biological A/O Process Systems.
W89-03149 5E		W89-03326 5D

NUTRITION

Effect of Activated Sludge in the Breeder Diet	Tract C-a, Rio Blanco County, Colorado,	W89-02963 5G
on the Reproduction Criteria and the Perform-	W89-02974 5B	OW AMONA
ance of their Offspring,	OIL BOLLUTION	OKLAHOMA
W89-03061 5E	OIL POLLUTION Treatment of Oil and Oily Wastes,	Annual Yield and Selected Hydrologic Data for the Arkansas River Basin Compact, Arkansas-
OBSERVATION WELLS	W89-02963 5G	Oklahoma, 1987 Water Year,
Groundwater Levels in Wyoming, 1978		W89-02602 2E
Through September 1987,	Biodegradation of Nitrogen- and Oxygen-Con-	
W89-02468 4B	taining Aromatic Compounds in Groundwater	Soil Testing As a Guide to Prudent Use of
Groundwater Levels in Wyoming, 1976	from an Oil-Contaminated Aquifer,	Nitrogen Fertilizers in Oklahoma Agriculture, W89-02664 7B
Through 1985,	W89-03149 5B	W89-02664 7B
W89-02525 7C	Sensitivity of Branchial Mucus to Crude Oil	Investigation of Nitrate Contamination in Shal-
	Toxicity in a Freshwater Fish, Colisa fasciatus,	low Ground Waters Near Woodward, Oklaho-
Map Showing Groundwater Levels in Anchor-	W89-03204 5C	ma,
age, Alaska, 1985,		W89-02671 5B
W89-02526 7C	Effects of Water Soluble Crude Oil Fractions on	Saline Seep on Wheatland in Northwest Oklaho-
OCEANOGRAPHY	Cirral Beat Frequency in Balanus balanoides, W89-03205 5C	ma,
Oceanography of Chesapeake Bay,	W 65-03203	W89-02672 5B
W89-02693 2L	Effect of Assam Crude on Photosynthesis and	
Physical Oceanography of the St. Laurence Ec.	Associated Electron Transport System in Ana-	Microerosion Processes and Sediment Mobiliza-
Physical Oceanography of the St. Lawrence Es- tuary,	baena doliolum,	tion in a Roadbank Gully Catchment in Central
W89-02698 2L	W89-03207 5C	Oklahoma, W89-02894 2J
	Comparison of Flow-Through and Towed	W 07-02074 23
Oceanographic Characteristics of the Seine Es-	Fluorometers for Measuring Oil Concentrations	Summary of the High Plains Regional Aquifer-
tuary,	in the Sea,	System Analysis in Parts of Colorado, Kansas,
W89-02699 2L	W89-03329 5A	Nebraska, New Mexico, Oklahoma, South
ODOR		Dakota, Texas, and Wyoming,
Emissions and Control of Offensive Odor in	OIL SHALE	W89-03030 2F
Wastewater Treatment Plants,	Effects of Organic Wastes from Processing of Green River Formation Oil Shale on Water	Effects of Future Ground-Water Pumpage on
W89-02962 5D	Quality,	the High Plains Aquifer in Parts of Colorado,
ODOD CONTROL	W89-02487 5B	Kansas, Nebraska, New Mexico, Oklahoma,
ODOR CONTROL Pretreatment of Drinking Water to Control Or-		South Dakota, Texas, and Wyoming,
ganic Contaminants and Taste and Odor,	Evaluation of Baseline Conditions at Lease	W89-03031 2F
W89-02793 5F	Tract C-a, Rio Blanco County, Colorado,	OLIGOTROPHIC LAKES
	W89-02974 5B	Utility of Soluble Reactive Phosphorus Meas-
Odour Control by Artificial Groundwater Re-	OIL SPILLS	urements in Great Lakes Surveillance Programs:
charge,	Quantitative Studies of Biodegradation of Petro-	A Summary,
W89-02799 5F	leum And Some Model Hydrocarbons in	W89-03180 5A
Anaerobic Biological Process for the Prevention	Ground Water and Sediment Environments,	
of Noxious Odors in Pulp Manufacturing,	W89-02674 5B	OLIVE MILL EFFLUENTS
W89-02928 5D	Fate of Cauda Oil at See and the Natural Disease	Influence of Na and Ca Alkalinity on UASB Treatment of Olive Mill Effluents: I. Preliminary
OGALLALA AQUIFER	Fate of Crude Oil at Sea and the Natural Dispersion of Crude Oils and Water-in-Oil Emulsions:	Results,
Quantity and Quality of Recharge to the Ogal-	Results of Experiments Using a Laboratory Test	W89-03116 5D
lala Aquifer from Urban Runoff,	Tank and Free-Floating Rings at Sea,	
W89-02340 4C	W89-02944 5B	ONTARIO
		Modification and Assessment of an Index of
Land and Water Management Issues: Texas	Oil Spill Combat in the Arctic - An Alternative	Biotic Integrity to Quantify Stream Quality in
High Plains, W89-02634 6D	Approach, W89-02966 5G	Southern Ontario, W89-03211 4C
W 03-02-03-4	W 89-02900 JG	W 05-03211
ОНЮ	Potential of Free-Living Ground Water Bacteria	Scaled Chrysophytes (Chrysophyceae) as Indi-
Hydrology of Area 8, Eastern Coal Province,	to Degrade Aromatic Hydrocarbons and Heter-	cators of pH in Sudbury, Ontario, Lakes,
West Virginia and Ohio,	ocyclic Compounds,	W89-03227 5A
W89-02598 4C	W89-03086 5B	OPACITY
Ohio Stream Regionalization Project: A Com-	Biodegradation Modeling at Aviation Fuel Spill	Relationships Among Secchi Disk Depth, Beam
pendium of Results,	Site,	Attenuation Coefficient, and Irradiance Attenu-
W89-02932 2H	W89-03100 5G	ation Coefficient for Great Lakes Waters,
OHIO RIVER		W89-03176 2H
Hydrology of Area 8, Eastern Coal Province,	Sensitivity of Branchial Mucus to Crude Oil	OPERATING COSTS
West Virginia and Ohio,	Toxicity in a Freshwater Fish, Colisa fasciatus, W89-03204 5C	Value Engineering for Small Communities.
W89-02598 4C	W 63-03204	W89-02865 6E
	Effects of Water Soluble Crude Oil Fractions on	
OIL	Cirral Beat Frequency in Balanus balanoides,	OPERATIONS
Separators and Emulsion Separation Systems for Petroleum, Oil, and Lubricants,	W89-03205 5C	Wastewater Treatment: Optimizing an Existing
W89-02808 5D	Comparison of Flow-Through and Towed	System,
3D	Fluorometers for Measuring Oil Concentrations	W89-02406 5D
Fate of Crude Oil at Sea and the Natural Disper-	in the Sea,	OPTICAL PROPERTIES
sion of Crude Oils and Water-in-Oil Emulsions:	W89-03329 5A	Numerical Model for the Computation of Radi
Results of Experiments Using a Laboratory Test		ance Distributions in Natural Waters with Wind
Tank and Free-Floating Rings at Sea, W89-02944 5B	OIL WASTES	Roughened Surfaces, Part II: User's Guide and
W89-02944 5B	Separators and Emulsion Separation Systems for	Code Listing,
OIL INDUSTRY	Petroleum, Oil, and Lubricants, W89-02808 5D	W89-02414 2F
Treatment of Process Wastewater from Petro-	. 57-02000	Relationships Among Secchi Disk Depth, Bean
chemical Plant Using a Rotating Biological Con-	Literature Study on the Feasibility of Microbio-	Attenuation Coefficient, and Irradiance Attenu
tactor - A Case Study, W89-02292 5D	logical Decontamination of Polluted Soils,	ation Coefficient for Great Lakes Waters,
W89-02292 5D	W89-02916 5G	W89-03176 2F

Measuring Water Clarity with a Black Disk, W89-03251 7B	New System of Seepage Sampling for the Deter- mination of Volatile Organic Substances (Neues	Modelling of Flow and Transport Processes in Vyredox and Nitredox Subsurface Treatment
OPTIMIZATION	System der Sickerwassergewinnung zur Bestim-	Plants,
Wastewater Treatment: Optimizing an Existing	mung Leichtfluchtiger Organischer Spuren- stoffe),	W89-03092 5F
System, W89-02406 5D	W89-03047 5A	OXIDATION-REDUCTION POTENTIAL Concept of Electron Activity and its Relation to
OREGON	Role of Protozoa in Microbial Acclimation for	Redox Potentials in Aqueous Geochemical Sys-
Selected Groundwater Information for the Co- lumbia Plateau Regional Aquifer System, Wash-	Mineralization of Organic Chemicals in Sewage, W89-03283 5D	tems, W89-02580 2K
ington and Oregon, 1982-1985: Volume I, Geo-	Results of a Short-Term Toxicity Study for	Biogenic Gases and the Oxidation and Reduc-
hydrology, W89-02572 7C	Three Organic Chemicals Found in Niagara River Drinking Water,	tion of Carbon in Amazon River and Floodplain Waters,
Selected Groundwater Information for the Co-	W89-03310 5C	W89-03247 2E
lumbia Plateau Regional Aquifer System, Washington and Oregon, 1982-1985: Volume II,	Organic Contaminants in Isolated Lakes of Southern Labrador, Canada,	OXYGEN High-Precision Respirometer for Measuring
Water Levels, W89-02573 7C	W89-03318 5B	Small Rates of Change in the Oxygen Concen-
	ORGANIC MATTER	tration of Natural Waters, W89-03252 7B
Correspondence Between Ecoregions and Spa- tial Patterns in Stream Ecosystems in Oregon, W89-03223 2H	Interactions of Organic Matter and Aluminum Ions in Acid Forest Soil Solutions: Metal Com-	OXYGEN DEPLETION Mobile Bay Estuary: Stratification, Oxygen De-
ORGANIC CARBON	plexation, Flocculation, and Precipitation, W89-03126 2K	pletion, and Jubilees,
Biogenic Gases and the Oxidation and Reduc-		W89-02696 2L
tion of Carbon in Amazon River and Floodplain Waters,	Hydrologic and Riparian Influences on the Import and Storage of Coarse Particulate Or- ganic Matter in a Prairie Stream,	OZONATION Wastewater Treatment: Ozonation Processes
W89-03247 2E	W89-03214 2H	and Equipment. Citations from the Selected
Trace Metal Transport in a Tropical Estuary,	ORGANORHOUSIADUS RESTIGIRES	Water Resources Abstracts Database (Jan 77 -
W89-03276 2L ORGANIC CHEMICALS	ORGANOPHOSPHORUS PESTICIDES Predicting the Effects of a Pesticide Release to the Rhine River,	Aug 87). W89-02786 5D
Groundwater Protection by Accelerated Testing of Organic Chemical Breakthroughs of Soil Bar-	W89-03159 5C	Biodegradation of Recalcitrant Industrial Wastes,
riers,	ORGANOTIN	W89-02926 5D
W89-02585 5A	Portable Environment Test System: A Field As- sessment of Organotin Leachates. Test and Eval-	OZONE
ORGANIC COMPOUNDS	uation,	Effects of Ozone and Acid Rain on White Pine
Partitioning of Toxic Organic Compounds on Municipal Wastewater Treatment Plant Solids, W89-02299 5D	W89-03324 5C	(Pinus strobus) Seedlings Grown in Five Soils: II. Mycorrhizal Infection,
	OROGRAPHIC PRECIPITATION Cumulus and Thunderstorm Initiation by Moun-	W89-03057 5C
Random Survey of VOC's, Pesticides and Inor- ganics in Arizona's Drinking Water Wells,	tains,	Effects of Ozone and Acid Rain on White Pine
W89-02344 5A	W89-02787 2B	(Pinus strobus) Seedlings Grown in Five Soils: III. Nutrient Relations, W89-03058 5C
Advantages of Suction Lift Hydrocarbon Re- covery Systems: Application At Three Hydro-	ORTHOPHOSPHATES Reuse of Chemical Sludge for Conditioning of	Contaminated Aquifers are a Forgotten Compo-
geologic Environments in California, W89-02358 5G	Biological Sludges, W89-02815 5D	nent of the Global N2O Budget, W89-03121 5B
	OUTFALL	
Water System Responses to Toxic Contamina- tion of Groundwater Supplies, W89-02586 5F	Ocean Outfall System for Dense and Buoyant Effluents,	OZONE LAYER DESTRUCTION Contaminated Aquifers are a Forgotten Compo-
Introduction to Interactions of Organic Com-	W89-03108 5E	nent of the Global N2O Budget, W89-03121 5B
pounds with Mineral Surfaces,	OVERLAND FLOW	PACIFIC REGION
W89-02643 5B	Controls on Overland Flow Generation, W89-02882 2E	Hydrogeological Mapping in Asia and the Pacif- ic Region.
Organic Chemicals in Natural Waters: Applied Monitoring and Impact Assessment,	Pattern of Wash Erosion Around an Upland	W89-02364 7B
W89-02776 5C	Stream Head,	PAHVANT VALLEY
Processes, Coefficients, and Models for Simulat-	W89-02886 2J	Elected Hydrologic Data for Pahvant Valley
ing Toxic Organics and Heavy Metals in Surface	OXIC-ANOXIC INTERFACES	and Adjacent Areas, Millard County, Utah, 1987,
Waters, W89-02788 5B	Contrasting Diel Patterns of Vertical Migration in the Dinoflagellate Ceratium hirundinella in	W89-02569 7C
Use of Rapid Small-Scale Column Tests to Pre-	Relation to Phosphorus Supply in a North Tem-	PAKISTAN
dict Full-Scale Adsorption Capacity and Per-	perate Reservoir, W89-03221 2H	Pakistan-Status Report, W89-02381 4B
formance, W89-02789 5F	OXIDATION	
Pretreatment of Drinking Water to Control Or-	Utilization of Nitrite Oxidation Inhibition to Im-	PALEOCLIMATOLOGY Vegetation and Climates of the Last 45,000
ganic Contaminants and Taste and Odor, W89-02793 5F	prove the Nitrogen Elimination Process, W89-02288 5D	Years in the Vicinity of the Nevada Test Site, South-Central Nevada, W89-03024 7C
Treatment of Hazardous Wastes in a Sequencing	Methane Cycling in the Sediments of Lake	
Batch Reactor, W89-02917 5D	Washington, W89-03249 2H	
Microbial, Chemical, and Technological Aspects		W89-03119 2L
of the Anaerobic Degradation of Organic Pollut- ants,		Effect of Climate on Development of Two Sphagnum Bogs in South-Central Wisconsin,
W89-02920 5D		

PALEOHYDROLOGY

PALEOHYDROLOGY Hydrological Development of Tropical Tower Karst: An Example from Peninsular Malaysia,	Modeling of Polychlorinated Biphenyls in Vadose Zone, W89-02353 5B	Acid Precipitation Literature Review 1986: Emission, Transport, Transformation and Depo- sition of Acidic Trace Species,
W89-02739 2F	Modeling Acid Migration Through Soils,	W89-02822 5B
Vegetation and Climates of the Last 45,000 Years in the Vicinity of the Nevada Test Site,	W89-02361 5B	Nearshore Transport Processes Affecting the Dilution and Fate of Energy-Related Contami-
South-Central Nevada, W89-03024 7C	Hydrogeologic and Geochemical Aspects of Contaminant Transport at the Falls City, Texas	nants, W89-02843 5B
Glacio-Eustatic Sea-Level Control on Red Sea Salinity,	UMTRA Site, W89-02362 5B	Intensive Survey of the Kishwaukee River and
W89-03119 2L	Estimating the Transport and Deposition of	its Tributaries, 1983. W89-02858 5C
PALEOLIMNOLOGY	Mining Waste at Ok Tedi,	
Comparison of Lake Sediments and Ombrotro- phic Peat Deposits as Long-Term Monitors of	W89-02461 2J	Preliminary Environmental Assessment of the Contamination Associated with Lake Calumet,
Atmospheric Pollution,	Predicting Chemical Movement in Soils, W89-02473 5B	Cook County, Illinois, W89-02870 5B
W89-02321 5A	Effects of Runoff Controls on the Quantity and	National Acid Precipitation Assessment Pro-
New Biological Marker Layer in the Sediments of the Great Lakes: Bythothrephes cederstroemi	Quality of Urban Runoff at Two Locations in Austin, Texas,	gram: Annual Report, 1986. W89-02873 5B
(Schodler) Spines, W89-03178 2H	W89-02518 5B	
	Consideration of Dimensional Department in	Suspended Sediment Properties and Their Geo-
PALEOZOIC CARBONATE-ROCK AQUIFERS Geophysical Logs and Hydrological Data for	Consideration of Dimensional Dependence in Modelling the Structure of Flow Zones within	morphological Significance, W89-02899 2J
Eight Wells in the Coyote Spring Valley Area, Clark and Lincoln Counties, Nevada,	the Subsurface, W89-02551 5B	Superfund Record of Decision: Northern En-
W89-02603 4B		graving, WI.
PARASITES	Analytically-Derived Sensitivities in One-Di- mensional Models of Solute Transport in Porous	W89-02938 5B
Diversity of the Parasite Assemblage of Fundu-	Media,	Gastrointestinal Absorption of Soluble Uranium
lus zebrinus in the Platte River of Nebraska, W89-03062 2H	W89-02595 5B	from Drinking Water, W89-02957 5B
PARASITISM	Metal Speciation: Theory, Analysis and Applica-	Rocky Mountain Acid Deposition Model As-
Engineering, Mosquitoes and Filariasis: A Case	tion. W89-02640 5B	sessment: Evaluation of Mesoscale Acid Deposi-
Report, W89-03065 5G	Thermodynamic Calculations with Special Ref-	tion Models for Use in Complex Terrain, W89-02969 5B
Schistosomiasis Control in Irrigation Schemes in	erence to the Aqueous Aluminum System,	
Zimbabwe,	W89-02641 2K	Nearshore Transport Processes Affecting the Dilution and Fate of Energy-Related Contami-
	Introduction to Interactions of Organic Com-	nants,
FORTICLE SIZE Formation of a Coarse Surface Layer as the	pounds with Mineral Surfaces, W89-02643 5B	W89-02972 5B
Response to Gravel Mobility,	Peretions and Tenernost of Tenes Metals in	Superfund Record of Decision: Kane and Lom- bard, MD.
W89-02440 2J	Reactions and Transport of Trace Metals in Groundwater,	W89-02977 5E
Investigation of Sediment Routing by Size Frac-	W89-02644 5B	Pilot Scale Evaluation of Sludge Landfilling:
tions in a Gravel-Bed River, W89-02444 2J	Metal Speciation and Interactions among Ele-	Four Years of Operation,
PARTICULATE MATTER	ments Affect Trace Element Transfer in Agri-	W89-02978 5E
Hydrologic and Riparian Influences on the	cultural and Environmental Food-Chains, W89-02650 5B	Groundwater Assessment Modeling Under the
Import and Storage of Coarse Particulate Or- ganic Matter in a Prairie Stream,	Trace Metal Speciation in Sediments and Soils:	Resource Conservation and Recovery Act, W89-02995 5B
W89-03214 2H	An Overview from a Water Industry Perspec-	
PARTITIONING	tive,	Installation Restoration Program Phase II - Con- firmation/Quantification. Stage I.
Partitioning of Toxic Organic Compounds on	W89-02651 5B	W89-02999 5B
Municipal Wastewater Treatment Plant Solids, W89-02299 5D	Transport, Bioaccumulation, and Toxicity of	Migration of Acidic Groundwater Seepage from
	Metals and Metalloids in Microorganisms under Environmental Stress,	Uranium-Tailings Impoundments: 1. Field Study
PASTURES Runoff Characteristics and Washoff Loads from	W89-02652 5B	and Conceptual Hydrogeochemical Model, W89-03037 5B
Rainfall-Simulation Experiments on a Street Sur-	Behavior And Subsurface Transport of Agro-	W89-03037
face and a Native Pasture in the Denver Metro- politan Area, Colorado,	chemicals in Conservation Systems,	Migration of Acidic Groundwater Seepage from Uranium-Tailings Impoundments: 2. Geochemi-
W89-03036 2E	W89-02667 5B	cal Behavior of Radionuclides in Groundwater,
PATH OF POLLUTANTS	Assessment of Empirical Methodologies for Pre-	W89-03038 5B
Consequences of Cloud Water Deposition on	dicting Ground Water Pollution from Agricul- tural Chemicals,	Migration of Acidic Groundwater Seepage from
Vegetation at High Elevation, W89-02305 5B	W89-02670 5B	Uranium-Tailings Impoundments: 3. Simulations of the Conceptual Model with Application to
Gas Chromatographic Residue Patterns of Toxa-	Interactive Simulation of Chemical Movement	Seepage Area A,
phene in Fish Samples from the Great Lakes and from Rivers of the Southeastern United States.	in Soil, W89-02675 5B	W89-03039 5B
W89-02328 5B		Investigations on Leaching of Dicyandiamide
Field Simulation of Waste Impoundment Seep-	Pesticide Impact on Stream Fauna with Special Reference to Macroinvertebrates,	and its Decomposition in Flooded Soils (Unter- suchungen zur Auswaschung von Dicyandiamid
age in the Vadose Zone,	W89-02773 5C	und Dessen Abbau in Uberstauten Boden),
W89-02348 5B	Processes, Coefficients, and Models for Simulat-	W89-03043 5B
Applying Electrical Resistance Blocks for Un-	ing Toxic Organics and Heavy Metals in Surface	Movement and Survival of Bacteria in Porous
saturated Zone Monitoring at Arid Sites, W89-02352 7B	Waters, W89-02788 5B	Media, W89-03080 5B
	35	

Effect of Unsaturated/Saturated Zone Property	Asbestos-Contaminated Drinking Water: Its	PENNSYLVANIA
Upon the Hydrogeochemical and Microbiologi- cal Processes Involved in the Migration and	Impact on Household Air, W89-03299 5B	Statistical Analyses of Flood Frequency, Low- Flow Frequency and Flow Duration of Streams
Attenuation of Landfill Leachate Components, W89-03087 5B	Concentration of Mycobacterium avium by Hos-	in the Philadelphia Area, Pennsylvania, W89-02492 2E
Temperature Dependence of Liquid Film Coef-	pital Hot Water Systems, W89-03304 5B	Ground Water and Agriculture: Addressing the
ficient for Gas Transfer,	Organic Contaminants in Isolated Lakes of	Information Needs of Pennsylvania's Chesa-
W89-03112 2K	Southern Labrador, Canada, W89-03318 5B	peake Bay Program, W89-02680 5G
Contaminated Aquifers are a Forgotten Compo- nent of the Global N2O Budget,		PENSTOCKS
W89-03121 5B	Lagrangian-Eulerian Approach to Modeling Hy- drogeochemical Transport of Multi-Component	Load-Sharing Linings: A New Design Concept for Large Diameter Penstocks,
Modeling of Total Nitrogen in River Using the Quantity-Quality Model CEQUEAU (Modelisa-	Systems, W89-03320 5B	W89-03158 8F
tion de l'Azote Total en Riviere a l'Aide du	Modeling Groundwater Transport of Dissolved	PENTABROMOCHLOROCYCLOHEXANE
Modele Quantite-Qualite CEQUEAU), W89-03130 5B	Gasoline and Using the Results to Evaluate Aq- uifer Restoration Processes,	Health and Environmental Effects Profile for 1,2,3,4,5-Penta-Bromo-6-Chlorocyclohexane.
Groundwater Contamination at a Landfill Sited	W89-03321 5B	W89-02866 5C
on Fractured Carbonate and Shale,	Comparison of Flow-Through and Towed	PERCOLATION
W89-03146 5B	Fluorometers for Measuring Oil Concentrations	Investigations on Leaching of Dicyandiamide
Groundwater Contamination by Nitrates and	in the Sea, W89-03329 5A	and its Decomposition in Flooded Soils (Unter- suchungen zur Auswaschung von Dicyandiamid
Chlorides Washed out from Phosphorite Ores in		und Dessen Abbau in Uberstauten Boden),
the Negev Desert, Israel, W89-03147 5B	PATH OF POLLUTATION	W89-03043 5B
	Influence of Cosolvents on Quinoline Sorption by Subsurface Materials and Clays,	PERFORMANCE EVALUATION
Simulations of Physical Nonequilibrium Solute	W89-03040 5B	Handbook: Improving POTW Performance
Transport Models: Application to a Large-Scale Field Experiment,	PATHOGENIC BACTERIA	Using the Composite Correction Program Ap-
W89-03148 2F	Temporal Relationship of Vibrio parahaemolyti-	proach, W89-02845 5D
Sandalaite Anabada of Advantion and December	cus in Patients and the Environment,	
Sensitivity Analysis of Adsorption and Degrada- tion Parameters in the Modeling of Pesticide	W89-03064 5B	Evaluation of Municipal Solid Waste Landfill Cover Designs,
Transport in Soils,	Groundwater Microbiology: Problems and Bio-	W89-02871 5E
W89-03150 2G	logical Treatment: State-of-the-Art Report, W89-03075 2F	PERMEABILITY
Solute Transport Modeling in Heterogeneous		Studies of Permeation of Gases with Disinfect-
Soils: Conjunctive Application of Physically	PAYETTE RIVER BASIN	ing Action Across Polymer Barriers,
Based and System Approaches, W89-03151 2G	Quality of Ground Water in the Payette River Basin, Idaho,	W89-03044 5F
	W89-03008 5G	PERMEABLE BARRIERS
Predicting the Effects of a Pesticide Release to	PEAK DISCHARGE	Permeable Barriers: A New Alternative for
the Rhine River, W89-03159 5C	Technique for Estimating Flood-Peak Discharge and Frequencies on Rural Streams in Illinois,	Treatment of Contaminated Ground Waters, W89-02355 5G
Photodegradation of the Lampricide 3-Trifluor-	W89-02512 2E	PERMITS
omethyl-4-nitrophenol (TFM): 2. Field Confir-	PEAK FLOW	Advisory System for North Carolina Ground-
mation of Direct Photolysis and Persistence of	Hydrology of the White Tail Butte Area, North-	water Quality Modeling and Management
Formulation Impurities in a Stream During Treatment,	ern Campbell County, Wyoming,	Needs, W89-02548 5G
W89-03175 5B	W89-02596 4C	
Distribution of Gamma-emitting Radionuclides	PEAT	PEROXIDES Ultra-Trace-Level Determination of Cobalt,
in Surface Subtidal Sediments Near the Sella- field Plant,	Runoff and Sediment Production in a Small Peat-Covered Catchment: Some Preliminary Re-	Chromium, and Hydrogen Peroxide by Luminol Chemiluminescence Detected With a Charge-
W89-03190 5B	sults, W89-02888 2E	Coupled Device,
Characteristics of the Sorption of Chlorothalonil		W89-03181 7B
and Azinphos-Methyl to a Soil from a Commer-	Acidification and Succession in a Flood-Plain	PERSONNEL
cial Cranberry Bog,	Mire in the Norfolk Broadland, U.K., W89-03123 2H	Hydrology and Hydrologists,
W89-03195 5B		W89-02727 2A
Hexachlorophene Distributions in Estuarine	PEAT BOGS Interactions of Sphagnum with Water and Air,	PESTICIDE RESIDUES
Sediments, W89-03196 5B	W89-02312 2H	DDT Residues in Sediments from the Bay of Bengal.
	Stratigraphic Record of Atmospheric Loading	W89-03198 5B
Effects of Liming on the Distribution of Cadmi- um in Water, Sediment, and Organisms in a	of Metals at the Ombrotrophic Big Heath Bog,	PESTICIDES
Swedish Lake,		resticides
W89-03224 5B	Mt. Desert Island, Maine, U.S.A., W89.02315	Fate of 4,6-Dinitro-o-Cresol in Municipal Acti-
	W89-02315 5B	Fate of 4,6-Dinitro-o-Cresol in Municipal Acti- vated Sludge Systems,
	W89-02315 5B Comparison of Lake Sediments and Ombrotro-	
Effects of Temperature, Salinity and Seagrass Species on the Uptake of Lead(II) from Sea-	W89-02315 5B	vated Sludge Systems, W89-02296 5D Gas Chromatographic Residue Patterns of Toxa-
Effects of Temperature, Salinity and Seagrass Species on the Uptake of Lead(II) from Sea- water by Excised Leaves,	W89-02315 5B Comparison of Lake Sediments and Ombrotrophic Peat Deposits as Long-Term Monitors of	vated Sludge Systems, W89-02296 5D Gas Chromatographic Residue Patterns of Toxa- phene in Fish Samples from the Great Lakes and
Effects of Temperature, Salinity and Seagrass Species on the Uptake of Lead(II) from Sea-	W89-02315 5B Comparison of Lake Sediments and Ombrotrophic Peat Deposits as Long-Term Monitors of Atmospheric Pollution, W89-02321 5A	vated Sludge Systems, W89-02296 Gas Chromatographic Residue Patterns of Toxaphene in Fish Samples from the Great Lakes and from Rivers of the Southeastern United States,
Effects of Temperature, Salinity and Seagrass Species on the Uptake of Lead(II) from Seawater by Excised Leaves, W89-03275 5B Mass Balance of Heavy Metals in the Seto	W89-02315 5B Comparison of Lake Sediments and Ombrotrophic Peat Deposits as Long-Term Monitors of Atmospheric Pollution, W89-02321 5A PEAT SOILS Natural and Anthropogenic Acidification of	vated Sludge Systems, W89-02296 Gas Chromatographic Residue Patterns of Toxaphene in Fish Samples from the Great Lakes and from Rivers of the Southeastern United States, W89-02328 5B
Effects of Temperature, Salinity and Seagrass Species on the Uptake of Lead(II) from Seawater by Excised Leaves, W89-03275 5B Mass Balance of Heavy Metals in the Seto Inland Sea, Japan,	W89-02315 5B Comparison of Lake Sediments and Ombrotrophic Peat Deposits as Long-Term Monitors of Atmospheric Pollution, W89-02321 5A PEAT SOILS Natural and Anthropogenic Acidification of Peatlands,	vated Sludge Systems, W89-02296 Gas Chromatographic Residue Patterns of Toxaphene in Fish Samples from the Great Lakes and from Rivers of the Southeastern United States, W89-02328 Random Survey of VOC's, Pesticides and Inor-
Effects of Temperature, Salinity and Seagrass Species on the Uptake of Lead(II) from Seawater by Excised Leaves, W89-03275 5B Mass Balance of Heavy Metals in the Seto Inland Sea, Japan, W89-03278 5B	W89-02315 5B Comparison of Lake Sediments and Ombrotrophic Peat Deposits as Long-Term Monitors of Atmospheric Pollution, W89-02321 5A PEAT SOILS Natural and Anthropogenic Acidification of Peatlands, W89-02311 5B	vated Sludge Systems, W89-02296 Gas Chromatographic Residue Patterns of Toxaphene in Fish Samples from the Great Lakes and from Rivers of the Southeastern United States, W89-02328 5B
Effects of Temperature, Salinity and Seagrass Species on the Uptake of Lead(II) from Seawater by Excised Leaves, W89-03275 5B Mass Balance of Heavy Metals in the Seto Inland Sea, Japan,	W89-02315 5B Comparison of Lake Sediments and Ombrotrophic Peat Deposits as Long-Term Monitors of Atmospheric Pollution, W89-02321 5A PEAT SOILS Natural and Anthropogenic Acidification of Peatlands,	vated Sludge Systems, W89-02296 5D Gas Chromatographic Residue Patterns of Toxaphene in Fish Samples from the Great Lakes and from Rivers of the Southeastern United States, W89-02328 5B Random Survey of VOC's, Pesticides and Inorganics in Arizona's Drinking Water Wells,

PESTICIDES

National Survey of Pesticides in Drinking Water Wells,	Literature Study on the Feasibility of Microbio- logical Decontamination of Polluted Soils,	PHOSPHORUS Total Phosphorus Budget for Lake St. Clair:
W89-02656 5B	W89-02916 5G	1975-80, W89-03168 5B
Nitrates and Pesticides in Ground Water: An Analysis of a Computer-Based Literature Search,	PHARMACEUTICAL INDUSTRY Industrial Wastewater Pretreatment of a Dental-Pharmaceutical Company,	Utility of Soluble Reactive Phosphorus Measurements in Great Lakes Surveillance Programs:
W89-02666 5B	W89-02805 5D	A Summary, W89-03180 5A
National Assessment of Ground Water Contamination from Pesticides and Fertilizers, W89-02673 5B	PHARMACEUTICAL WASTES Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition.	Prediction of Phosphorus Release Rates from Total and Reductant-Soluble Phosphorus in
Incentives and Institutions to Reduce Pesticide	Volume I, W89-02948 5D	Anoxic Lake Sediments, W89-03210 2H
Contamination of Ground Water, W89-02677 5G	Evaluation of Biological Treatment of Pharma-	Contrasting Patterns of Net- and Nanoplankton
Pesticide Impact on Stream Fauna with Special	ceutical Wastewater with PAC Addition. Volume II - Appendices,	Production and Biomass Among Lakes, W89-03218 2H
Reference to Macroinvertebrates, W89-02773 5C	W89-02949 5D	Silica and Phosphorus Flux from Sediments: Importance of Internal Recycling in Lake Michi-
Pesticide and Synthetic Organic Compound	PHENOLS Anoxic/Oxic Activated Sludge Treatment of	gan,
Survey: Report to the Iowa General Assembly on the Results of the Water System Monitoring	Cyanogens and Ammonia in the Presence of Phenols,	W89-03219 2H
Required by House File 2303. W89-02836 5F	W89-02298 5D	Contrasting Diel Patterns of Vertical Migration in the Dinoflagellate Ceratium hirundinella in Relation to Phosphorus Supply in a North Tem-
Literature Study on the Feasibility of Microbio- logical Decontamination of Polluted Soils,	Calpurnia and the Strip Barn, W89-02411 5D	perate Reservoir, W89-03221 2H
W89-02916 5G	Application of XAD-4 Solid Sorbent and HPLC	Sediment Record of Biogeochemical Responses
Extraction, Clean-up and Group Separation Techniques in Organochlorine Trace Analysis,	with Electrochemical Detection to the Analysis of Phenols in Water,	to Anthropogenic Perturbations of Nutrient Cycles in Lake Ontario,
W89-03068 5A	W89-02420 5A	W89-03222 2H
Sensitivity Analysis of Adsorption and Degrada- tion Parameters in the Modeling of Pesticide	Treatment of Hazardous Wastes in a Sequencing Batch Reactor,	Growth and Phosphorous Status of Limnetic
Transport in Soils, W89-03150 2G	W89-02917 5D	Phytoplankton and Bacteria, W89-03244 2H
	Anaerobic Degradation of Phenolic Compounds with Applications to Treatment of Industrial	Phosphorous Flux from Lake Sediments: Effect
Predicting the Effects of a Pesticide Release to the Rhine River, W89-03159 5C	Waste Waters, W89-02918 5D	of Epipelic Algal Oxygen Production, W89-03248 2H
Characteristics of the Sorption of Chlorothalonil and Azinphos-Methyl to a Soil from a Commercial Cranberry Bog,	Role of Phenolic and Humic Compounds in Anaerobic Digestion Processes, W89-02924 5D	PHOSPHORUS REMOVAL Influence of Sludge from Chemical Biological Wastewater Treatment on Nitrification and Di- gestion,
W89-03195 5B	Photodegradation of the Lampricide 3-Trifluor-	W89-02816 5D
Hexachlorophene Distributions in Estuarine Sediments, W89-03196 5B	omethyl-4-nitrophenol (TFM): 2. Field Confir- mation of Direct Photolysis and Persistence of Formulation Impurities in a Stream During Treatment,	Enhanced Biological Phosphorus Removal from Waste Waters, W89-02931 5D
DDT Residues in Sediments from the Bay of Bengal,	W89-03175 5B	PHOTOCHEMICAL REDUCTION
W89-03198 5B	Photodecomposition of Chlorophenols in Aque-	Dye-Sensitized Photochemical Reduction of PCBs,
Diffubenzuron Application to Citrus and Its Impact on Invertebrates in an Adjacent Pond,	ous Medium in Presence of Hydrogen Peroxide, W89-03200 5B	W89-03101 5D
W89-03208 5C Capillary Gas Chromatographic Determination	Acute Toxicity of Malathion, Tetrabromobis- phenol-A, and Tributyltin Chloride to Mysids (Mysidopsis bahia) of Three Ages,	PHOTODECOMPOSITION Photodecomposition of Chlorophenols in Aqueous Medium in Presence of Hydrogen Peroxide,
of Amitrole in Water with Alkali Flame Ioniza- tion Detection,	W89-03203 5C	W89-03200 5B
W89-03287 5A	PHENYLENEDIAMINE	PHOTOGRAMMETRY Sources of Sediment and Channel Changes in
Movement of Carbofuran (Nematicide) in Soil Columns,	Health and Environmental Effects Profile for Phenylenediamines.	Small Catchments of Romania's Hilly Regions, W89-02896 2J
W89-03297 5B	W89-02868 5C	PHOTOIONIZATION DETECTORS
In Vivo and In Vitro Effect of Triclorfon on Esterases of the Red Crayfish Procambarus clar- kii,	PHILIPPINES Hydrogeological Mapping in the Philippines, W89-02382 2F	Recognizing Petroleum Hydrocarbon Contami- nation in the Vadose Zone with Photoionization Detection Scanning of Field Samples,
W89-03314 5C	PHOSPHATES	W89-02351 5A
Pesticides in Fish Tissue and Water from Tuttle Creek Lake, Kansas, W89-03317 5B	Phosphate Requirement for Anaerobic Fixed Film Treatment of Landfill Leachate, W89-03132 5D	PHOTOMETRY Determination of Metals with ICP-AES in Comparison to the AAS, Photometry, and Millival-
Portable Environment Test System: A Field Assessment of Organotin Leachates. Test and Eval-	Comparison of Phosphorus Dynamics in Two Oklahoma Reservoirs and a Natural Lake Vary-	Balance of the Anions (Die Metallbestimmung mit der ICP-AES im Vergleich zur AAS, Pho- tometrie und Anionen-Millival-Bilanz),
uation, W89-03324 5C	ing in Abiogenic Turbidity, W89-03232 2H	W89-03048 5A
PETROLEUM PRODUCTS	Kinetic Control of Dissolved Phosphate in Natu-	PHOTOSYNTHESIS Change in Distribution Patterns of Photosynthe
Separators and Emulsion Separation Systems for Petroleum, Oil, and Lubricants,	ral Rivers and Estuaries: A Primer on the Phosphate Buffer Mechanism,	tically Incorporated C during Phytoplanktor Bloom in Controlled Experimental Ecosystem
W89-02808 5D	W89-03253 2K	W89-03059 21

Photosynthetic Carbon Metabolism by Phyto- plankton in a Nitrogen-Limited Reservoir,	PIEDMONTS Experimental Geomorphology (Drainage Net-	PLANKTON Plankton,
W89-03215 2H	work, Piedmont and Channel Morphology),	W89-02770 2L
PHREATOPHYTES Evapotranspiration of Phreatophytes in the San	W89-02847 2J PIEZOMETERS	Microflagellate-Picoplankton Food Linkage in the Water Column of Lake Biwa,
Luis Valley, Colorado, W89-02478 2D	Description of Piezometer Nests and Water Levels in the Rio Grande Valley Near Albu-	W89-03245 2H
Evapotranspiration of Native Vegetation in the	querque, Bernalillo County, New Mexico,	High-Precision Respirometer for Measuring Small Rates of Change in the Oxygen Concen-
Closed Basin of the San Luis Valley, Colorado, W89-02481 2D	W89-02509 2F PIKE	tration of Natural Waters, W89-03252 7B
Evapotranspiration Rates at Selected Sites in the Powder River Basin, Wyoming and Montana,	Effects of Liming on the Distribution of Cadmi- um in Water, Sediment, and Organisms in a	Comparison of the Ecology of Planktonic Bacte-
W89-02524 Sasin, Wyoming and Montana,	Swedish Lake, W89-03224 5B	ria in Fresh and Salt Water, W89-03258 2H
PHYSICOCHEMICAL PROPERTIES	PILOT PLANTS	Phototrophic Picoplankton: An Overview from
Littoral Zoobenthic Biomass in Lakes, and Its Relationship to Physical, Chemical, and Trophic Factors.	Pilot-Scale Anaerobic Biomass Acclimation Studies with a Coal Liquefaction Wastewater,	Marine and Freshwater Ecosystems, W89-03259 2H
W89-03229 2H	W89-02297 5D	Production and Use of Detritus in Various
PHYSICOCHEMICAL TREATMENT Synergistic Approach to Physical-Chemical	Use of Rapid Small-Scale Column Tests to Pre- dict Full-Scale Adsorption Capacity and Per-	Freshwater, Estuarine, and Coastal Marine Eco- systems,
Wastewater Pretreatment in the Food Industry, W89-02802 5D	formance, W89-02789 5F	W89-03266 2H Effects of Cadmium Exposure on Feeding of
PHYSIOCHEMICAL PROPERTIES	Pilot Scale Evaluation of Sludge Landfilling:	Freshwater Planktonic Crustaceans, W89-03288 5C
Studies of Permeation of Gases with Disinfect- ing Action Across Polymer Barriers,	Four Years of Operation, W89-02978 5E	
W89-03044 5F	PINE TREES	PLANNING Fish (Survey of),
Correspondence Between Ecoregions and Spa-	Effects of Ozone and Acid Rain on White Pine	W89-02771 7B
tial Patterns in Stream Ecosystems in Oregon, W89-03223 2H	(Pinus strobus) Seedlings Grown in Five Soils: II. Mycorrhizal Infection,	Pretreatment of Industrial Wastewater: Legal and Planning AspectsA Case Study,
PHYTOPLANKON Plankton.	W89-03057 5C	W89-02800 5D
W89-02770 2L	Effects of Ozone and Acid Rain on White Pine (Pinus strobus) Seedlings Grown in Five Soils: III. Nutrient Relations,	PLASTIC PIPES Behaviour of Buried Small Flexible Pipes,
PHYTOPLANKTON	W89-03058 5C	W89-03137 8G
Change in Distribution Patterns of Photosynthe- tically Incorporated C during Phytoplankton	PIPE EROSION	PLATTE RIVER
Bloom in Controlled Experimental Ecosystem, W89-03059 2L	Pipeflow and Pipe Erosion in the Maesnant Ex- perimental Catchment,	Diversity of the Parasite Assemblage of Fundu- lus zebrinus in the Platte River of Nebraska, W89-03062 2H
Photosynthetic Carbon Metabolism by Phyto-	W89-02884 2E	PLUMES
plankton in a Nitrogen-Limited Reservoir, W89-03215 2H	PIPE FLOW	Migration of Acidic Groundwater Seepage from
Emergence of Chironomidae (Diptera) in Fertil-	Air Demand and Conduit Pressures, Stillhouse Hollow Dam, Lampasas River, Texas, W89-02415 8B	Uranium-Tailings Impoundments: 1. Field Study and Conceptual Hydrogeochemical Model,
ized and Natural Lakes at Saqvaqjuac, N.W.T., W89-03216 2H	PIPELINES	W89-03037 5B
Contrasting Patterns of Net- and Nanoplankton Production and Biomass Among Lakes,	Effects on Suspended and Substrate Sediments in Two Streams Resulting from Different Gas-	Migration of Acidic Groundwater Seepage from Uranium-Tailings Impoundments: 2. Geochemi- cal Behavior of Radionuclides in Groundwater,
W89-03218 2H	Pipeline Installation Techniques, W89-02823 4C	W89-03038 5B
Dynamics of Lake Michigan Phytoplankton: Re- lationship to Nitrogen and Silica Fluxes, W89-03230 2H	Effects of Gas-Pipeline Construction on the Aquatic Ecosystem of Canada Creek, Presque	Migration of Acidic Groundwater Seepage from Uranium-Tailings Impoundments: 3. Simulations
W89-03230 2H Growth and Phosphorous Status of Limnetic	Isle County, Michigan, W89-02861 4C	of the Conceptual Model with Application to Seepage Area A,
Phytoplankton and Bacteria, W89-03244 2H	PIPES	W89-03039 5B
Effect of pH on Iron and Manganese Uptake by	Use of Remote Gauging to Measure Sewer Invert Elevations and Head Loss,	Influence of a River Plume on the Sea-ice Meio- fauna in South-eastern Hudson Bay,
a Green Alga, W89-03246 5C	W89-03280 5D	W89-03189 2L PLUTONIUM
Comparative Ecology of Marine and Freshwater	PIPING	Pu(239,240) Residence Times in Freshwaters
Phytoplankton, W89-03260 2H	Pipeflow and Pipe Erosion in the Maesnant Ex- perimental Catchment,	and Accumulation in Shield Lake Sediments, W89-03209 2H
Nutrient Limitation of Phytoplankton in Fresh-	W89-02884 2E	PODZOLS
water and Marine Environments: A Review of Recent Evidence on the Effects of Enrichment, W89-03261 2H	PISCICIDES Photodegradation of the Lampricide 3-Trifluoromethyl-4-nitrophenol (TFM): 2. Field Confir-	Limits on Cation Leaching of Weakly Podzo- lized Forest Soils: An Empirical Evaluation, W89-02310 5B
Prediction of Reservoir Phytoplankton Condi-	mation of Direct Photolysis and Persistence of Formulation Impurities in a Stream During	POLAND
tion by the Fluorescence Method, W89-03291 2H	Treatment, W89-03175 5B	Water and Sediment Dynamics of the Homerka Catchment,
PICOPLANKTON	In Vivo and In Vitro Effect of Triclorfon on	W89-02895 2J
Phototrophic Picoplankton: An Overview from Marine and Freshwater Ecosystems,	Esterases of the Red Crayfish Procambarus clar- kii,	POLAROGRAPHIC ANALYSIS Iodine Speciation in Chesapeake Bay Waters,
W89-03259 2H	W89-03314 5C	

POLICY ANALYSIS

POLICY ANALYSIS	POLYCHLORINATED BIPHENYLS	Polyelectrolytes for the Treatment of Tap and
Power Behind the Flood Scene,	Modeling of Polychlorinated Biphenyls in	Filter Back Washing Water,
W89-02747 6E	Vadose Zone,	W89-02797 5F
POLICY MAKING	W89-02353 5B	Treatment of Botable Water from Secul Varia
Attempt to Facilitate Water Management Issues	Des Consistent District Deduction of	Treatment of Potable Water from Seoul, Korea
	Dye-Sensitized Photochemical Reduction of	by Flotation, Filtration and Adsorption,
in the Zambezi River Basin Using Decision Sup- port Systems,	PCBs, W89-03101 5D	W89-03319 5F
W89-03145 5G	W89-03101 5D	POTENTIAL EVAPORATION
***************************************	Horizontal and Vertical Distribution of PCBs in	Influence of Potential Evaporation on the Varia-
POLLUTANT IDENTIFICATION	Southern Lake Michigan Sediments and the	bilities of Simulated Soil Wetness and Climate,
Random Survey of VOC's, Pesticides and Inor-	Effect of Waukegan Harbor as a Point Source,	W89-03308 2D
ganics in Arizona's Drinking Water Wells,	W89-03170 5B	17 07-03300
W89-02344 5A	11 07-03110	POTENTIOMETRIC LEVEL
	Distribution Pattern and Reduction of Polychlo-	Generalized Potentiometric Surface of the
Recognizing Petroleum Hydrocarbon Contami-	rinated Biphenyls (PCB) in Bluefish Pomatomus	Sparta-Memphis Aquifer, Eastern Arkansas,
nation in the Vadose Zone with Photoionization	saltatrix (Linnaeus) Fillets through Adipose	Spring 1980,
Detection Scanning of Field Samples,	Tissue Removal,	W89-02575 7C
W89-02351 5A	W89-03199 5B	
Two Test Procedures for Radon in Drinking		Geohydrology and Susceptibility of Major
Water: Interlaboratory Collaborative Study,	POLYELECTROLYTES	Aquifers to Surface Contamination in Alabama,
	Polyelectrolytes for the Treatment of Tap and	Area 1,
W89-02956 5A	Filter Back Washing Water,	W89-02578 5B
Deuterium Isotope Composition of Palaeoinfil-	W89-02797 5F	
tration Waters Trapped in Speleothems,		Geohydrology and Susceptibility of Major
W89-02981 5A	POLYMERS	Aquifers to Surface Contamination in Alabama,
W07-04301	New Porous Polymer for Off-Line Preconcen-	Area 6,
New System of Seepage Sampling for the Deter-	tration of Chlorophenols from Water,	W89-02590 5B
mination of Volatile Organic Substances (Neues	W89-03286 5A	
System der Sickerwassergewinnung zur Bestim-		POTENTIOMETRIC SURFACE
mung Leichtfluchtiger Organischer Spuren-	POPULATION DENSITY	Potentiometric Surface of the Upper Floridan
stoffe),	Relative Abundance and Distribution of Young-	Aquifer in the St. Johns River Water Manage-
W89-03047 5A	of-the-Year Fishes and Minnows in Lake	ment District and Vicinity, Florida, September
110700017	Sharpe, South Dakota,	1987,
Determination of Metals with ICP-AES in Com-	W89-02426 2H	W89-02503 7C
parison to the AAS, Photometry, and Millival-		
Balance of the Anions (Die Metallbestimmung	POPULATION DYNAMICS	Potentiometric Surface of the Intermediate Aq-
mit der ICP-AES im Vergleich zur AAS, Pho-	Estuarine Invertebrates and Fish: Sampling	uifer System, West-Central Florida, September
tometrie und Anionen-Millival-Bilanz),	Design and Constraints for Long-Term Meas-	1986,
W89-03048 5A	urements of Population Dynamics,	W89-02532 7C
	W89-02327 2L	
Utility of Soluble Reactive Phosphorus Meas-		Geohydrology and Susceptibility of Major
urements in Great Lakes Surveillance Programs:	Zooplankton Biomass Exchange in Lake Sharpe,	Aquifers to Surface Contamination in Alabama,
A Summary,	South Dakota, 1974-1975,	Area 7,
W89-03180 5A	W89-02425 2H	W89-02577 5B
P. (220 240) P		
		POTOMAC RIVER
Pu(239,240) Residence Times in Freshwaters	POPULATION EFFECTS	
and Accumulation in Shield Lake Sediments,	Estuaries: Concern Over Troubled Waters,	Flow Simulation Model of the Tidal Potomac
		Flow Simulation Model of the Tidal Potomac River,
and Accumulation in Shield Lake Sediments, W89-03209 2H	Estuaries: Concern Over Troubled Waters, W89-03279 7A	Flow Simulation Model of the Tidal Potomac
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ioniza-	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout,	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ioniza- tion Detection,	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure,	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ioniza-	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout,	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution,
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ioniza- tion Detection,	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rain-	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water:	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry,	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water:	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Perform-
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring,
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples,	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Perform-
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents,	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharma-
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents,	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition.
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrome-	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I,
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry,	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Alumi-	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition.
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrome-	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I,
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Os-	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharma-
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A Acute Toxicity and Behavioral Effects of Acry-	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Osmoregulation, W89-03242 5C	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition.
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A Acute Toxicity and Behavioral Effects of Acrylates and Methacrylates to Juvenile Fathead	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Osmoregulation, W89-03242 5C POROUS MEDIA	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharma-
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A Acute Toxicity and Behavioral Effects of Acrylates and Methacrylates to Juvenile Fathead Minnows,	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Osmoregulation, W89-03242 5C POROUS MEDIA Movement and Survival of Bacteria in Porous	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume II - Appendices, W89-02949 5D
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A Acute Toxicity and Behavioral Effects of Acrylates and Methacrylates to Juvenile Fathead	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Osmoregulation, W89-03242 5C POROUS MEDIA Movement and Survival of Bacteria in Porous Media,	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume II - Appendices,
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A Acute Toxicity and Behavioral Effects of Acrylates and Methacrylates to Juvenile Fathead Minnows, W89-03313 5C Pesticides in Fish Tissue and Water from Tuttle	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Osmoregulation, W89-03242 5C POROUS MEDIA Movement and Survival of Bacteria in Porous	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume II - Appendices, W89-02949 5D
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A Acute Toxicity and Behavioral Effects of Acrylates and Methacrylates to Juvenile Fathead Minnows, W89-03313 5C Pesticides in Fish Tissue and Water from Tuttle Creek Lake, Kansas,	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Osmoregulation, W89-03242 5C POROUS MEDIA Movement and Survival of Bacteria in Porous Media, W89-03080 5B	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume II - Appendices, W89-02949 5D POWERPLANTS Uprating the Laufenburg Swiss/German Power Station with Ten Straflo Units,
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A Acute Toxicity and Behavioral Effects of Acrylates and Methacrylates to Juvenile Fathead Minnows, W89-03313 5C Pesticides in Fish Tissue and Water from Tuttle	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Osmoregulation, W89-03242 5C POROUS MEDIA Movement and Survival of Bacteria in Porous Media, W89-03080 5B PORTLAND CEMENT	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume II - Appendices, W89-02949 5D POWERPLANTS Uprating the Laufenburg Swiss/German Power
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A Acute Toxicity and Behavioral Effects of Acrylates and Methacrylates to Juvenile Fathead Minnows, W89-03313 5C Pesticides in Fish Tissue and Water from Tuttle Creek Lake, Kansas, W89-03317 5B	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Osmoregulation, W89-03242 5C POROUS MEDIA Movement and Survival of Bacteria in Porous Media, W89-03080 5B PORTLAND CEMENT Sulfate Resistance of Mortars Made Using Port-	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume II - Appendices, W89-02949 5D POWERPLANTS Uprating the Laufenburg Swiss/German Power Station with Ten Straflo Units, W89-03071 8C
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A Acute Toxicity and Behavioral Effects of Acrylates and Methacrylates to Juvenile Fathead Minnows, W89-03313 5C Pesticides in Fish Tissue and Water from Tuttle Creek Lake, Kansas, W89-03317 5B	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Osmoregulation, W89-03242 5C POROUS MEDIA Movement and Survival of Bacteria in Porous Media, W89-03080 5B PORTLAND CEMENT Sulfate Resistance of Mortars Made Using Portland Cement and Blends of Portland Cement and	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaccutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharmaccutical Wastewater with PAC Addition. Volume II - Appendices, W89-02949 5D POWERPLANTS Uprating the Laufenburg Swiss/German Power Station with Ten Straflo Units, W89-03071 8C PRAIRIES
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A Acute Toxicity and Behavioral Effects of Acrylates and Methacrylates to Juvenile Fathead Minnows, W89-03313 5C Pesticides in Fish Tissue and Water from Tuttle Creek Lake, Kansas, W89-03317 5B POLLUTANTS POLLUTANTS	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Osmoregulation, W89-03242 5C POROUS MEDIA Movement and Survival of Bacteria in Porous Media, W89-03080 5B PORTLAND CEMENT Sulfate Resistance of Mortars Made Using Portland Cement and Blends of Portland Cement and Pozzolan or Slag,	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume II - Appendices, W89-02949 5D POWERPLANTS Uprating the Laufenburg Swiss/German Power Station with Ten Straflo Units, W89-03071 8C PRAIRIES Hydrology and Chemistry of Selected Prairie
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A Acute Toxicity and Behavioral Effects of Acrylates and Methacrylates to Juvenile Fathead Minnows, W89-03313 5C Pesticides in Fish Tissue and Water from Tuttle Creek Lake, Kansas, W89-03317 5B POLLUTANTS POLENTIANTS Potential for Treatment of Hazardous Organic Chemicals with Biological Processes,	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Osmoregulation, W89-03242 5C POROUS MEDIA Movement and Survival of Bacteria in Porous Media, W89-03080 5B PORTLAND CEMENT Sulfate Resistance of Mortars Made Using Portland Cement and Blends of Portland Cement and	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume II - Appendices, W89-02949 5D POWERPLANTS Uprating the Laufenburg Swiss/German Power Station with Ten Straflo Units, W89-03071 8C PRAIRIES Hydrology and Chemistry of Selected Prairie Wetlands in the Cottonwood Lake Area, Stuts-
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A Acute Toxicity and Behavioral Effects of Acrylates and Methacrylates to Juvenile Fathead Minnows, W89-03313 5C Pesticides in Fish Tissue and Water from Tuttle Creek Lake, Kansas, W89-03317 5B POLLUTANTS POLLUTANTS	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Osmoregulation, W89-03242 5C POROUS MEDIA Movement and Survival of Bacteria in Porous Media, W89-03080 5B PORTLAND CEMENT Sulfate Resistance of Mortars Made Using Portland Cement and Blends of Portland Cement and Pozzolan or Slag, W89-02714 8F	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume II - Appendices, W89-02949 5D POWERPLANTS Uprating the Laufenburg Swiss/German Power Station with Ten Straflo Units, W89-03071 8C PRAIRIES Hydrology and Chemistry of Selected Prairie Wetlands in the Cottonwood Lake Area, Stutsman County, North Dakota, 1979-82,
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A Acute Toxicity and Behavioral Effects of Acrylates and Methacrylates to Juvenile Fathead Minnows, W89-03313 5C Pesticides in Fish Tissue and Water from Tuttle Creek Lake, Kansas, W89-03317 5B POLLUTANTS POLENIAMIS Potential for Treatment of Hazardous Organic Chemicals with Biological Processes, W89-02929 5D	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Osmoregulation, W89-03242 5C POROUS MEDIA Movement and Survival of Bacteria in Porous Media, W89-03080 5B PORTLAND CEMENT Sulfate Resistance of Mortars Made Using Portland Cement and Blends of Portland Cement and Pozzolan or Slag, W89-02714 8F POTABLE WATER	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume II - Appendices, W89-02949 5D POWERPLANTS Uprating the Laufenburg Swiss/German Power Station with Ten Straflo Units, W89-03071 8C PRAIRIES Hydrology and Chemistry of Selected Prairie Wetlands in the Cottonwood Lake Area, Stuts-
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A Acute Toxicity and Behavioral Effects of Acrylates and Methacrylates to Juvenile Fathead Minnows, W89-03313 5C Pesticides in Fish Tissue and Water from Tuttle Creek Lake, Kansas, W89-03317 5B POLLUTANTS Potential for Treatment of Hazardous Organic Chemicals with Biological Processes, W89-02929 5D	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Osmoregulation, W89-03242 5C POROUS MEDIA Movement and Survival of Bacteria in Porous Media, W89-03080 5B PORTLAND CEMENT Sulfate Resistance of Mortars Made Using Portland Cement and Blends of Portland Cement and Pozzolan or Slag, W89-02714 8F POTABLE WATER Technologies and Costs for the Treatment of	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaccutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharmaccutical Wastewater with PAC Addition. Volume II - Appendices, W89-02949 5D POWERPLANTS Uprating the Laufenburg Swiss/German Power Station with Ten Straflo Units, W89-03071 8C PRAIRIES Hydrology and Chemistry of Selected Prairie Wetlands in the Cottonwood Lake Area, Stutsman County, North Dakota, 1979-82, W89-03035 2H
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A Acute Toxicity and Behavioral Effects of Acrylates and Methacrylates to Juvenile Fathead Minnows, W89-03313 5C Pesticides in Fish Tissue and Water from Tuttle Creek Lake, Kansas, W89-03317 5B POLLUTANTS Potential for Treatment of Hazardous Organic Chemicals with Biological Processes, W89-02929 5D POLONIUM-210 Biogeochemistry of Lead-210 and Polonium-210	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Osmoregulation, W89-03242 5C POROUS MEDIA Movement and Survival of Bacteria in Porous Media, W89-03080 5B PORTLAND CEMENT Sulfate Resistance of Mortars Made Using Portland Cement and Blends of Portland Cement and Pozzolan or Slag, W89-02714 8F Technologies and Costs for the Treatment of Microbial Contaminants in Potable Water Sup-	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume II - Appendices, W89-02949 5D POWERPLANTS Uprating the Laufenburg Swiss/German Power Station with Ten Straflo Units, W89-02049 8C PRAIRIES Hydrology and Chemistry of Selected Prairie Wetlands in the Cottonwood Lake Area, Stutsman County, North Dakota, 1979-82, W89-03035 2H PRECIPITATION
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A Acute Toxicity and Behavioral Effects of Acrylates and Methacrylates to Juvenile Fathead Minnows, W89-03313 5C Pesticides in Fish Tissue and Water from Tuttle Creek Lake, Kansas, W89-03317 5B POLLUTANTS Potential for Treatment of Hazardous Organic Chemicals with Biological Processes, W89-02929 5D POLONIUM-210 Biogeochemistry of Lead-210 and Polonium-210 in Fresh Waters and Sediments,	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Osmoregulation, W89-03242 5C POROUS MEDIA Movement and Survival of Bacteria in Porous Media, W89-03080 5B PORTLAND CEMENT Sulfate Resistance of Mortars Made Using Portland Cement and Blends of Portland Cement and Pozzolan or Slag, W89-02714 8F POTABLE WATER Technologies and Costs for the Treatment of Microbial Contaminants in Potable Water Supplies.	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume II - Appendices, W89-02949 5D POWERPLANTS Uprating the Laufenburg Swiss/German Power Station with Ten Straflo Units, W89-03071 8C PRAIRIES Hydrology and Chemistry of Selected Prairie Wetlands in the Cottonwood Lake Area, Stutsman County, North Dakota, 1979-82, W89-03035 2H PRECIPITATION Relationships between Snow Cover and Tem-
and Accumulation in Shield Lake Sediments, W89-03209 2H Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ionization Detection, W89-03287 5A Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale, W89-03301 5A Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrometry, W89-03303 5A Acute Toxicity and Behavioral Effects of Acrylates and Methacrylates to Juvenile Fathead Minnows, W89-03313 5C Pesticides in Fish Tissue and Water from Tuttle Creek Lake, Kansas, W89-03317 5B POLLUTANTS Potential for Treatment of Hazardous Organic Chemicals with Biological Processes, W89-02929 5D POLONIUM-210 Biogeochemistry of Lead-210 and Polonium-210	Estuaries: Concern Over Troubled Waters, W89-03279 7A POPULATION EXPOSURE Accumulation of Cadmium by Rainbow Trout, Salmo Gairdneri, During Extended Exposure, W89-03220 5B Long-Term Sublethal Acid Exposure in Rainbow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry, W89-03226 5C Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents, W89-03234 5C Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Osmoregulation, W89-03242 5C POROUS MEDIA Movement and Survival of Bacteria in Porous Media, W89-03080 5B PORTLAND CEMENT Sulfate Resistance of Mortars Made Using Portland Cement and Blends of Portland Cement and Pozzolan or Slag, W89-02714 8F POTABLE WATER Technologies and Costs for the Treatment of Microbial Contaminants in Potable Water Supplies.	Flow Simulation Model of the Tidal Potomac River, W89-02529 2L POULTRY Poultry Manure Management and Ground Water Quality: The Delaware Solution, W89-02678 5G POULTRY DIETS Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Performance of their Offspring, W89-03061 5E POWDERED ACTIVATED CARBON Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I, W89-02948 5D Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume II - Appendices, W89-02949 5D POWERPLANTS Uprating the Laufenburg Swiss/German Power Station with Ten Straflo Units, W89-02049 8C PRAIRIES Hydrology and Chemistry of Selected Prairie Wetlands in the Cottonwood Lake Area, Stutsman County, North Dakota, 1979-82, W89-03035 2H PRECIPITATION

Circulation in East Asia and Precipitation in China.	Pretreatment for Wastewater Reclamation and Reuse,	PUBLIC PARTICIPATION Project Appraisal, Resource Allocation and
W89-02609 2C	W89-02820 5D	Public Involvement,
Potential Impacts of a Scenario of CO2-Induced	PRIMARY PRODUCTIVITY	W89-02758 6E
Climatic Change on Ontario, Canada, W89-03063 2A	Emergence of Chironomidae (Diptera) in Fertil- ized and Natural Lakes at Saqvaqjuac, N.W.T.,	Volunteer Lake Monitoring Program, 1987.
	W89-03216 2H	Volume I: Statewide Summary Report, W89-02869 7B
Oklahoma-Kansas Mesoscale Convective System of 10-11 June 1985: Precipitation Struc-	Contrasting Patterns of Net- and Nanoplankton	PUBLIC POLICY
ture and Single-Doppler Radar Analysis, W89-03273 2B	Production and Biomass Among Lakes, W89-03218 2H	Clean Technology in the Netherlands: The Role
Relationship of Surface Pressure Features to the		of the Government, W89-02801 5G
Precipitation and Airflow Structure of an In-	Dynamics of Lake Michigan Phytoplankton: Re- lationship to Nitrogen and Silica Fluxes,	PUBLICATIONS
tense Midlatitude Squall Line, W89-03274 2B	W89-03230 2H	Selected Literature on Water Resources Investi-
	PROBABILITY DISTRIBUTION	gations in New Jersey by the U.S. Geological Survey, Through 1986,
Estimate of Precipitation Enhancement Potential for the Duero Basin of Spain,	Estimating Generalized Skew of the Log-Pear- son Type III Distribution for Annual Peak	W89-02466 10C
W89-03306 3B	Floods in Illinois,	Water Resources Publications of the U.S. Geo-
PRETREATMENT OF WASTES	W89-03006 2E	logical Survey, For Tennessee, 1906-1987,
Application of Statistical Process Control to Wastewater Pretreatment,	Probability and Stochastic Modelling of Water	W89-02467 10C
W89-02404 5D	Quality Parameters in the Thames River, W89-03135 5B	PUERTO RICO
PRETREATMENT OF WATER	Probability Distribution for Critical DO Loca-	History of Annual Streamflows from the 21 Water Resources Regions in the United States
Pretreatment in Chemical Water and	tion in Streams,	and Puerto Rico, 1951-83,
Wastewater Treatment. W89-02791 5G	W89-03292 7B	W89-02493 7C
From Filters to Forests: Water Treatment and	PROCESS CONTROL	Superfund Record of Decision: Vega Alta, PR. W89-02984 5G
Supply,	Application of Statistical Process Control to Wastewater Pretreatment,	
W89-02792 5F	W89-02404 5D	PUGET SOUND Puget Sound: A Fjord System Homogenized
Pretreatment of Drinking Water to Control Or-	PROJECT PLANNING	with Water Recycled over Sills by Tidal Mixing,
ganic Contaminants and Taste and Odor, W89-02793 5F	Project Appraisal, Resource Allocation and Public Involvement,	W89-02694 2L
Water Quality Problems and Control Strategies	W89-02758 6E	PULP AND PAPER INDUSTRY
for the Water Supply of Tianjin City,	Planning Biological Surveys,	Anaerobic Biological Process for the Prevention of Noxious Odors in Pulp Manufacturing,
W89-02794 5F	W89-02760 7B	W89-02928 5D
Humic Substances Removal by Alum Coagula- tion: Direct Filtration at Low pH,	Operations for an Under-Ice Ecology Program,	Anaerobic Treatment of Sulfate-Containing
W89-02795 5F	W89-03179 2H	Waste Water, W89-02930 5D
Polyelectrolytes for the Treatment of Tap and	PROTOZOA Role of Protozoa in Microbial Acclimation for	
Filter Back Washing Water, W89-02797 5F	Mineralization of Organic Chemicals in Sewage,	Syntrophic Bacteria Process to Convert a Pulp Mill's Spent Sulphite Liquor to Hydrogen Sul-
Pretreatment of Industrial Wastewater: Legal	W89-03283 5D	phide, W89-03115 5D
and Planning AspectsA Case Study,	PUBLIC HEALTH Assessing the Health Effects of Floods,	
W89-02800 5D	W89-02757 2E	Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft
Synergistic Approach to Physical-Chemical Wastewater Pretreatment in the Food Industry,	Health and Environmental Effects Profile for	Pulp Mill Effluents, W89-03234 50
W89-02802 5D	1,2,3,4,5-Penta-Bromo-6-Chlorocyclohexane. W89-02866 5C	PULP WASTES
Pretreatment of Wastewater from the Automo-		Syntrophic Bacteria Process to Convert a Puli
bile Industry, W89-02804 5D	Health and Environmental Effects Profile for Phenylenediamines.	Mill's Spent Sulphite Liquor to Hydrogen Sul
	W89-02868 5C	phide, W89-03115 5E
Industrial Wastewater Pretreatment of a Dental- Pharmaceutical Company,	Appendicitis Epidemic Following Introduction	Physiological Disturbances in Fish Living in
W89-02805 5D	of Piped Water to Anglesey, W89-03041 5F	Coastal Water Polluted with Bleached Krai Pulp Mill Effluents,
Alternative Treatment of De-Icing Fluids from	Problems of the Toxicological Compatibility of	W89-03234 50
Airports, W89-02807 5D	Hydrogen Peroxide in Drinking and Swimming	PUMPAGE
Hydrogen Sulphide Control in Municipal	Pool Water for Humans from the Pharmacokine- tic and Biochemical Points of View (Probleme	Effects of Future Ground-Water Pumpage of
Sewers,	Der Humantoxikologischen Vertraglichkeit von Wasserstoffperoxid in Bade- and Trinkwasser	the High Plains Aquifer in Parts of Colorado Kansas, Nebraska, New Mexico, Oklahoma
W89-02810 5D	aus Biochemischer und Pharmakokinetischer	South Dakota, Texas, and Wyoming,
Coagulation as the First Step in Wastewater Treatment,	Sicht), W89-03042 5C	
W89-02811 5D	You and Your Drinking Water: Health Implica-	PUMPING Optimizing Operation and Maintenance of
Chemically Supported Oil and Grease Removal	tions for the Use of Cation Exchange Water	Water Supply Wells,
in Municipal Wastewater Treatment Plants,	Softeners,	W89-02333 6
		Advantages of Suction Lift Hydrocarbon Re
Pretreatment of Sludge Liquors in Sewage Treatment Plants.	Engineering, Mosquitoes and Filariasis: A Case Report.	covery Systems: Application At Three Hydro geologic Environments in California,
11/00 00017 FD	11/00 02068	33/00 00360

PUMPING TESTS

PUMPING TESTS	RADIOISOTOPES	RAINFALL-RUNOFF RELATIONSHIP
Role of Aquifer Testing in Design of Constant- Head Extraction Systems,	Pre-Feasibility on Streamflow Gauging Using Radioisotope Tracer Method for Kemumbu Ag-	Runoff and Sediment Transport Dynamics in Canadian Badland Micro-Catchments,
W89-02346 7B	riculture Development Authority (KADA),	W89-02887 2E
QUALITY ASSURANCE	W89-02713 2E	RAINFALL-RUNOFF RELATIONSHIPS
External Quality-Assurance Results for the Na-	Deuterium Isotope Composition of Palaeoinfil-	Ephemeral Runoff and Groundwater Recharge,
tional Atmospheric Deposition Program and Na-	tration Waters Trapped in Speleothems,	W89-02350 2F
tional Trends Network During 1986, W89-02463 7C	W89-02981 5A	Techniques for Estimating Regional Flood
W 89-02463	Migration of Acidic Groundwater Seepage from	Characteristics of Small Rural Watersheds in the
QUALITY CONTROL	Uranium-Tailings Impoundments: 2. Geochemi-	Plains Region of Eastern Colorado,
Monitoring and Quality Assurance Procedures	cal Behavior of Radionuclides in Groundwater, W89-03038 5B	W89-02507 2E
for the Study of Remote Watershed Ecosystems, W89-02330 5A	W 67-03036	Rainfall-Runoff Data for Somerset County, New
	Distribution of Gamma-emitting Radionuclides	Jersey,
QUATERNARY AMMONIUM COMPOUNDS	in Surface Subtidal Sediments Near the Sella- field Plant.	W89-02592 2E
Review of Environmental Toxicity of Quater-	W89-03190 5B	Hydrology of the White Tail Butte Area, North-
nary Ammonium Halides, W89-03298 5C		ern Campbell County, Wyoming,
	RADIOMETRY	W89-02596 4C
QUEBEC	Influence of Snow Structure Variability on Global Snow Depth Measurement using Micro-	Hadadada Day for Hida Challes in the
Above- and Below-Ground Macrophyte Pro-	wave Radiometry,	Hydrologic Data for Urban Studies in the Austin Metropolitan Area, Texas, 1986,
duction in Scirpus Tidal Marshes of the St. Lawrence Estuary, Quebec,	W89-02620 7B	W89-02597 4C
W89-03055 2L	Batical of Case Water Facilities Case	
BIDID	Retrieval of Snow Water Equivalent from Nimbus-7 SMMR Data,	Hydrology of Area 8, Eastern Coal Province,
PADAR Observation of Stratiform Rain with 94 GHz	W89-02621 7B	West Virginia and Ohio, W89-02598 4C
and S-Band Doppler Radar,		11 07-02376
W89-02830 2B	Nimbus-7 SMMR Snow Cover Data, W89-02622 7C	Peak/Risk/Culvert: A Program to Compute
Ollahar Variable Committee	W89-02622 7C	Peak Flows, Hydrologic Risk, and Circular Cul-
Oklahoma-Kansas Mesoscale Convective System of 10-11 June 1985: Precipitation Struc-	Snow Cover Monitoring Using Microwave Ra-	vert Sizes at Forest Road Crossings, W89-02831 2E
ture and Single-Doppler Radar Analysis,	diometry,	W 69-02631
W89-03273 2B	W89-02623 7B	Experimental Geomorphology (Drainage Net-
Discussio Tanksions for Torontino during Air	Nimbus-7 Global Cloud Climatology: Part I.	work, Piedmont and Channel Morphology),
Diagnostic Technique for Targeting during Air- borne Seeding Experiments in Wintertime	Algorithms and Validation,	W89-02847 2J
Storms over the Sierra Nevada,	W89-03307 2B	Controls on Overland Flow Generation,
W89-03305 2B	RADON	W89-02882 2E
RADIANCE	Two Test Procedures for Radon in Drinking	Spatial Variability of Soil Hydrodynamic Prop-
Numerical Model for the Computation of Radi-	Water: Interlaboratory Collaborative Study,	erties in the Petite Fecht Catchment, Soultzeren,
ance Distributions in Natural Waters with Wind-	W89-02956 5A	France - Preliminary Results,
Roughened Surfaces, Part II: User's Guide and	RAIN	W89-02883 2G
Code Listing, W89-02414 2H	Observation of Stratiform Rain with 94 GHz	Floodplain Response of a Small Tropical
W89-02414 2H	and S-Band Doppler Radar,	Stream,
RADIOACTIVE DATING	W89-02830 2B	W89-02885 2E
Sediment Record of Biogeochemical Responses	RAIN GAGES	Runoff and Sediment Production in a Small
to Anthropogenic Perturbations of Nutrient Cycles in Lake Ontario,	Development and Field Use of a Snow Collec-	Peat-Covered Catchment: Some Preliminary Re-
W89-03222 2H	tor for Acid Precipitation Studies,	sults,
	W89-02945 5B	W89-02888 2E
RADIOACTIVE TRACERS Biogeochemistry of Lead-210 and Polonium-210	RAINFALL	Rapid Subsurface Flow and Streamflow Solute
in Fresh Waters and Sediments,	Rainfall-Runoff Data for Somerset County, New	Losses in a Mixed Evergreen Forest, New Zea-
W89-02555 2K	Jersey, W89-02592 2E	land,
Application of Co 127 Todaines to Bottom		W89-02890 2G
Application of Cs-137 Techniques to Problems of Sediment Redistribution in Sungai Lui Repre-	Satellite Rainfall Retrieval by Logistic Regres-	Water and Sediment Dynamics of the Homerka
sentative Basin, Selangor, Malaysia: Part I.	sion, W89-02854 7C	Catchment,
W89-02712 2J	107-02634	W89-02895 2J
Pre-Feasibility on Streamflow Gauging Using	Design of the Primary Pre-TRMM and TRMM	Estimating Magnitude and Frequency of Floods
Radioisotope Tracer Method for Kemumbu Ag-	Ground Truth Site, W89-02971 7A	for Wisconsin Urban Streams,
riculture Development Authority (KADA),	W09-02971	W89-03003 2E
W89-02713 2E	Stochastic Modelling of Rainfall Occurrences in	REACTIVATION
Factors Controlling the Biogeochemical Cycles	Continuous Time, W89-03049 2B	Experiences with Granular Activated Carbon
of Trace Elements in Fresh and Coastal Marine	W 89-03049 2B	Filtration and On-Site Reactivation at Jeffersor
Waters as Revealed by Artificial Radioisotopes,	Eurasian Snow Cover and Seasonal Forecast of	Parish, Louisiana,
W89-03263 2H	Indian Summer Monsoon Rainfall,	W89-02790 5F
RADIOACTIVE WASTES	W89-03054 2B	RECHARGE
Hydrology and Water Quality at the Weldon	RAINFALL DISTRIBUTION	Hydrologic and Geologic Data for the Edwards
Spring Radioactive Waste-Disposal Sites, St.	Stochastic Modelling of Rainfall Occurrences in	Aquifer Recharge Zone Near Georgetown, Wil
Charles County, Missouri, W89-02528 5B	Continuous Time, W89-03049 2B	liamson County, Texas, 1986-87, W89-02499 21
Distribution of Gamma-emitting Radionuclides	RAINFALL INTENSITY	RECREATION
in Surface Subtidal Sediments Near the Sella- field Plant,	Design of the Primary Pre-TRMM and TRMM Ground Truth Site,	Bacterial Loadings from Resuspended Sediment in Recreational Beaches,
W89-03190 5B		W89-03136 51
	122	

RECREATION WASTES	Historical Basis for Limits on Lake Superior	RESEARCH
Bacterial Loadings from Resuspended Sediments	Water Level Regulations,	Fiscal Year 1986 Program Report (Colorado
in Recreational Beaches,	W89-03173 4A	Water Resources Research Institute),
W89-03136 5B	REMOTE SENSING	W89-02477 9D
RECYCLING	Progression of Regional Snow Melt,	Fiscal Year 1986 Program Report (Wyoming
Waste Treatment and Recycling of Mixed	W89-02610 2C	Water Research Center),
Wastewater from a Metal Finishing Company,	Snow Cover Record in Eurasia.	W89-02479 9D
W89-02408 5D	W89-02612 2C	
RED RIVER VALLEY		Fiscal Year 1987 Report (Georgia Water Re-
Water Level Measurements 1981-85 and Chemi-	Distribution of Snow Cover in China, W89-02613 2C	sources Research Institute), W89-02553 9D
cal Analyses 1978-85, Red River Alluvial Aqui-	W 89-02013 2C	W89-02553 9D
fer, Red River Valley, Louisiana,	Snow Surveying in Canada,	Fiscal Year 1987 Program Report (North Caroli-
W89-02582 7C	W89-02614 7B	na Water Resources Research Institute).
RED SEA	Northern Hemisphere Snow and Ice Chart of	W89-02554 9D
Glacio-Eustatic Sea-Level Control on Red Sea	NOAA/NESDIS,	Fiscal Year 1986 Program Report (Virgin Is-
Salinity,	W89-02616 2C	lands Water Resources Research Center),
W89-03119 2L	NOAA Satellite-Derived Snow Cover Data	W89-02588 9D
REFURBISHMENT	Base: Past, Present, and Future,	
Rehabilitation of the Kuratau Station in New	W89-02617 2C	RESEARCH FACILITIES
Zealand.	6 6 D. 6 1 1 D. D.	Directory of Precipitation Monitoring Sites, Na-
W89-03154 8C	Snow Cover Data: Status and Future Prospects, W89-02618 7B	tional Atmospheric Deposition Program/Na-
The Later of the California Washing Window to	W 89-02018	tional Trends Network (NADP/NTN). W89-02480 7A
Updating and Refurbishing Hydro Plants in India,	Comparison of Northern Hemisphere Snow	W89-02480 7A
W89-03155 8C	Cover Data Sets,	RESEARCH NEEDS
W 65-03133	W89-02619 7C	Hydrological Sciences in Perspective,
Extending the Operating Life of Hydro Equip-	Influence of Snow Structure Variability on	W89-02718 2A
ment,	Global Snow Depth Measurement using Micro-	
W89-03156 8C	wave Radiometry,	RESEARCH PRIORITIES
REGIONAL ANALYSIS	W89-02620 7B	U.S.D.A. Agricultural Research Service Commitment to Ground Water Research,
Regionalization of Winter Low-flow Character-	Retrieval of Snow Water Equivalent from	W89-02655 3F
istics of Tennessee Streams,	Nimbus-7 SMMR Data,	W 65-02055
W89-03005 2E	W89-02621 7B	Surface Water Hydrology,
REGIONAL PLANNING	Nimbus-7 SMMR Snow Cover Data,	W89-02719 2E
Water and Arid Lands of the Western United	W89-02622 7C	Considerator Hudralani
States.		Groundwater Hydrology, W89-02720 2F
W89-02630 6D	Snow Cover Monitoring Using Microwave Ra-	W 65-02/20
REGRESSION ANALYSIS	diometry, W89-02623 7B	Snow and Ice,
Satellite Rainfall Retrieval by Logistic Regres-	W89-02623 7B	W89-02722 2C
sion,	Remote Sensing of Snow Properties in Moun-	Facility and California
W89-02854 7C	tainous Terrain,	Erosion and Sedimentation, W89-02723 2J
	W89-02624 7B	W 69-02/23
Simulation of Flood Hydrographs for Georgia	Review of 183 GHz Moisture Profile Retrieval	Hydrology versus Water Resources Manage-
Streams, W89-03002 5E	Studies,	ment,
W 67-03002	W89-02705 7C	W89-02724 2A
Estimating Magnitude and Frequency of Floods	Snow and Ice,	Hydrology and Hydrologists,
for Wisconsin Urban Streams,	W89-02722 2C	W89-02727 2A
W89-03003 2E		W 05-02/2/
REGULATED RIVERS	Remote Sensing,	NAPAP Operating Research Plan: 1986-1988.
Attempt to Facilitate Water Management Issues	W89-02761 7B	W89-02876 5B
in the Zambezi River Basin Using Decision Sup-	Observation of Stratiform Rain with 94 GHz	P I I for dire North
port Systems,	and S-Band Doppler Radar,	Research and Information Necus,
W89-03145 5G	W89-02830 2B	W89-02993 2H
REGULATIONS	Satellite Rainfall Retrieval by Logistic Regres-	RESEARCH PROJECTS
New Approaches to Monitoring Aquatic Eco-	sion,	Fiscal Year 1986 Program Report (New York
systems.	W89-02854 7C	
W89-02317 5A	D. M	W89-02471 9D
Liebility for Managing Hamadays Wester, Best	Bed Topography Inferred From Airborne	
Liability for Managing Hazardous Wastes: Past, Present and Future,	Radio-Echo Sounding of Columbia Glacier, Alaska,	sources Research Institute),
W89-02398 6E		W89-02553 9E
Environmental Auditing: Management's Key to		riscar rear 1700 riogram report (massache
Effective Environmental Compliance,	bilities of Simulated Soil Wetness and Climate, W89-03308 2D	setts water resources research center,
W89-02409 6A		W89-02587 9E
Regulation of the Agricultural Utilization of	REPRODUCTION	RESERVOIR LININGS
Sewage Sludge in New Jersey,	Effect of Long-Term Exposure to Acid, Alumi-	Geomembrane Liner Deduces Leakage in Un
W89-02676 5E	num, and Low Calcium on Adult Brook Trout	AA Di-
Incentives and Institutions to Reduce Pesticide	(Salvelinus fontinalis): II. Vitellogenesis and Os- moregulation.	W89-03281 51
Contamination of Ground Water,	W89-03242 5C	
W89-02677 5G		RESERVOIR MANAGEMENT
	Chronic Effects of Cu on Reproduction of Poly-	
Watertown, Minnesota: Flood Proofing Infor-		gineer).
mation. W89-02939 6F	and Food, W89-03296 50	

RESERVOIR RELEASES

RESERVOIR RELEASES	RESISTIVITY	Nutrient Limitation of Phytoplankton in Fresh-
Effects of Steady versus Fluctuating Flows on Aquatic Macroinvertebrates in the Colorado River below Glen Canyon Dam, Arizona,	Improved Fresh Water Assessment in Sand Aquifers Utilizing Geophysical Well Logs, W89-02347 2F	water and Marine Environments: A Review of Recent Evidence on the Effects of Enrichment, W89-03261 2H
W89-02940 6G	RESOURCE ALLOCATION	Forested Wetlands in Freshwater and Salt-
RESERVOIR SILTING	Project Appraisal, Resource Allocation and Public Involvement,	Water Environments,
Reservoir Sedimentation and Influence of Flush- ing,	W89-02758 6E	W89-03265 2H
W89-02457 2J	RESOURCE CONSERVATION AND	Production and Use of Detritus in Various Freshwater, Estuarine, and Coastal Marine Eco-
Design Problems in Gravel-Bed Rivers, Alaska, W89-02458 2J	RECOVERY ACT Liability for Managing Hazardous Wastes: Past, Present and Future,	systems, W89-03266 2H
RESERVOIR YIELD	W89-02398 6E	Comparative Ecology of the Macrofauna of
Hydrologic Design Methodologies for Prefeasi- bility Studies of Small-Scale Hydro at Ungauged	Toxicity of Selected RCRA Compounds to Activated Sludge Microorganisms,	Freshwater and Marine Muds, W89-03268 2H
Sites, W89-03129 7A	W89-03165 5D	Physical Energy Inputs and the Comparative
	RESPIRATION	Ecology of Lake and Marine Ecosystems,
RESERVOIRS Limnological and Fishery Studies on Lake	Respiration-Based Evaluation of Nitrification In-	W89-03272 2A
Sharpe, a Main-stem Missouri River Reservoir, 1964-1975,	hibition Using Enriched Nitrosomonas Cultures, W89-02302 7B	Review of Environmental Toxicity of Quater- nary Ammonium Halides,
W89-02423 2H	Effects of Low pH and Aluminum on Ventila-	W89-03298 5C
Water Quality Assessment of Arvada Reservoir,	tion in the Brook Trout (Salvelinus fontinalis), W89-03240 5C	RHINE RIVER
Denver Metropolitan Area, Colorado, W89-02562 2H	High-Precision Respirometer for Measuring	Predicting the Effects of a Pesticide Release to the Rhine River,
	Small Rates of Change in the Oxygen Concen-	W89-03159 5C
Water Quality of Canyon Lake, Central Texas, W89-02579 2H	tration of Natural Waters, W89-03252 7B	RIO GRANDE
		Hydrologic Analysis of the Rio Grande Basin
Martins Fork Lake Sedimentation Study: Hy- draulic Model Investigation,	RESPIROMETERS	North of Embudo, New Mexico, Colorado and
W89-02780 2J	High-Precision Respirometer for Measuring Small Rates of Change in the Oxygen Concen-	New Mexico, W89-02589 2F
Dynamic Reservoir Interaction with Monticello Dam,	tration of Natural Waters, W89-03252 7B	RIO GRANDE VALLEY
W89-02848 8A	RESPIROMETRY	Description of Piezometer Nests and Water Levels in the Rio Grande Valley Near Albu-
Temperature Analysis, Howard A. Hanson Res-	High-Precision Respirometer for Measuring Small Rates of Change in the Oxygen Concen-	querque, Bernalillo County, New Mexico,
ervoir, Washington: Mathematical Model Inves-	tration of Natural Waters,	W89-02509 2F
tigation, W89-02877 2H	W89-03252 7B	RIO PUERCO
Valves in Reservoir Outlets,	RETENTION TIME	Field Study of Ephemeral Stream-Aquifer Inter- action,
W89-03072 8C	Pu(239,240) Residence Times in Freshwaters and Accumulation in Shield Lake Sediments,	W89-02349 2F
Radial Stem Growth of Coniferous Trees near	W89-03209 2H	RIO SALADA
Swedish Reservoirs, W89-03142 6G	RETURN FLOW	Field Study of Ephemeral Stream-Aquifer Inter-
	Recharge as Augmentation in the South Platte Basin,	action, W89-02349 2F
Effect of Impoundment on the Growth of Bagrus docmac in Lake Nasser,	W89-02482 4B	RIPARIAN LAND
W89-03143 6G	REVERSE OSMOSIS	Role of Riparian Woods in Regulating Nitrogen
Photosynthetic Carbon Metabolism by Phyto- plankton in a Nitrogen-Limited Reservoir,	Membrane Separation Technologies for Treat- ment of Hazardous Wastes,	Fluxes Between the Alluvial Aquifer and Surface Water: A Conceptual Model,
W89-03215 2H	W89-03284 5D	W89-03140 6G
Comparison of Phosphorus Dynamics in Two	REVIEWS	RIPARIAN VEGETATION
Oklahoma Reservoirs and a Natural Lake Vary- ing in Abiogenic Turbidity,	Nitrogen Fixation in Freshwater, Estuarine, and Marine Ecosystems: 1. Rates and Importance, W89-03254 2H	Hydrologic and Riparian Influences on the Import and Storage of Coarse Particulate Or-
W89-03232 2H		ganic Matter in a Prairie Stream, W89-03214 2H
Geomembrane Liner Reduces Leakage in Un- derground Reservoir,	Nitrogen Fixation in Freshwater, Estuarine, and Marine Ecosystems: 2. Biogeochemical Con-	RIPARIAN WATERS
W89-03281 5F	trols, W89-03255 2H	Environmental Management of the Zambezi River System,
Prediction of Reservoir Phytoplankton Condi-	Denitrification in Freshwater and Coastal	W89-03144 5G
tion by the Fluorescence Method, W89-03291 2H	Marine Ecosystems: Ecological and Geochemi- cal Significance,	Attempt to Facilitate Water Management Issues
RESIDENCE TIMES	W89-03256 2H	in the Zambezi River Basin Using Decision Sup- port Systems.
Estuarine Residence Times,	Comparison of Microbial Dynamics in Marine	W89-03145 5G
W89-02688 2L	and Freshwater Sediments: Contrasts in Anaero-	RISING STAGE
RESIDUAL CURRENTS	bic Carbon Catabolism,	Effects of Fluctuating River-Pool Stages on
Modeling of Tidally Induced Residual Currents,	W89-03257 2H	Groundwater Levels in the Adjacent Alluvial
W89-02690 2L	Comparison of the Ecology of Planktonic Bacte- ria in Fresh and Salt Water,	Aquifer in the Lower Arkansas River, Arkansas, W89-02561 2F
Application of YADA Solid Sorbest and UDLC	W89-03258 2H	RISK ASSESSMENT
Application of XAD-4 Solid Sorbent and HPLC with Electrochemical Detection to the Analysis		Application of Environmental Risk Analysis to
of Phenols in Water,	Marine and Freshwater Ecosystems,	Groundwater Protection,
W89-02420 5A	W89-03259 2H	W89-03083 5G

Social Choice and Benefit-Cost Analysis, W89-02756 6B	ized River in England Subject to Long-Term River Maintenance and Management Works,	Roughness Coefficients for Densely Vegetated Flood Plains,
RIVER BASINS	W89-03139 6G	W89-02502 2E
Hydrology of Area 59, Northern Great Plains and Rocky Mountain Coal Provinces, Colorado	Mathematical Hydraulic Model of the River Nene a Canalized, and Heavily Controlled	RUBBER SEALS Rubber Seals for Steel Hydraulic Gates,
and Wyoming, W89-02501 2E	River, W89-03141 4A	W89-03074 8G
		RUNOFF
RIVER BEDS	Environmental Management of the Zambezi	Ephemeral Runoff and Groundwater Recharge,
Differences Between Gravel- and Sand-bed	River System,	W89-02350 2F
Rivers, W89-02431 2J	W89-03144 5G	
W 67-02431	Predicting the Effects of a Pesticide Release to	Transport Processes at the Catchment Scale,
RIVER ICE	the Rhine River,	W89-02437 2J
Role of Ice in the Morpho-Sedimentologic	W89-03159 5C	History of Annual Streamflows from the 21
Regime of a Shoreline in the Middle Saint Law- rence Estuary (Le Role des Glaces dans le	Measuring Water Clarity with a Black Disk,	Water Resources Regions in the United States
Regime Morpho-Sedimentologique d'un Estran	W89-03251 7B	and Puerto Rico, 1951-83,
de l'Estuaire Moyen du Saint-Laurent),		W89-02493 7C
W89-03133 2J	Kinetic Control of Dissolved Phosphate in Natu-	Controls on Overland Flow Generation,
RIVER MOUTH	ral Rivers and Estuaries: A Primer on the Phos- phate Buffer Mechanism,	W89-02882 2E
Influence of a River Plume on the Sea-ice Meio-	W89-03253 2K	
fauna in South-eastern Hudson Bay,		Floodplain Response of a Small Tropical
W89-03189 2L	ROADBANKS	Stream, W89-02885 2E
***************************************	Microerosion Processes and Sediment Mobiliza-	W89-02885 ZE
Magnitude and Frequency Characteristics of	tion in a Roadbank Gully Catchment in Central Oklahoma,	Pattern of Wash Erosion Around an Upland
Magnitude and Frequency Characteristics of Suspended Sediment Transport in Devon	W89-02894 2J	Stream Head,
Rivers,		W89-02886 21
W89-02904 2J	ROCK	Runoff and Sediment Production in a Small
Englacial Bassach on South African Bissach	Development of Groundwater Resources in Sri	Peat-Covered Catchment: Some Preliminary Re
Ecological Research on South African Rivers - A Preliminary Synthesis,	Lanka, W89-02383 4B	sults,
W89-02982 2H	W 07-02303	W89-02888 2E
	ROCK PROPERTIES	B-11 C-1
Conservation of South African Rivers,	Configuration and Hydrology of the Pre-Creta-	Rapid Subsurface Flow and Streamflow Solute Losses in a Mixed Evergreen Forest, New Zea
W89-02985 2H	ceous Rocks Underlying the Southeastern Coast-	land,
Riverine Ecosystems,	al Plain Aquifer System, W89-03007 2F	W89-02890 20
W89-02986 2H		
Conservation Aims, Criteria, and Goals for	ROCKAWAY BOROUGH WELL FIELD	RUNOFF FORECASTING
Rivers,	Superfund Record of Decision: Rockaway Bor-	Synoptic-Scale Assessment of Surface Runoff W89-02703
W89-02987 2H	ough Well Field, NJ. W89-02706 5D	W 89-02703
G	W 82-02/00	SAFE DRINKING WATER ACT
Conservation Management Options for Rivers, W89-02989 6A	ROCKS	Implications of the Clean Water Act and Saf
W 07-02707	Hydrogeological Problems of Hard Rock Areas	Drinking Water Act Legislation for Southwest
River Response to Catchment Conditions,	of Southern India, W89-02374 2F	ern Indian Tribes: Water-Quality Managemen and Indian Self Determination,
W89-02990 2H	W 07-023/4	W89-02334 50
Monitoring and Surveillance,	Notes on the Hydrogeological Map of Sarawak,	
W89-02991 7B	W89-02378 2F	Liability for Managing Hazardous Wastes: Pas
Birry Commenties Inclination for Lorida	Hydrogeological Mapping in the Philippines,	Present and Future,
River Conservation - Implications for Legisla- tion,	W89-02382 2F	W89-02398 6i
W89-02992 6E		SAINT LAWRENCE ESTUARY
	Intertidal Rock, W89-02767 2L	Role of Ice in the Morpho-Sedimentologi
Research and Information Needs,	W 69-02/07 2L	Regime of a Shoreline in the Middle Saint Law
W89-02993 2H	ROCKY MOUNTAINS	rence Estuary (Le Role des Glaces dans l Regime Morpho-Sedimentologique d'un Estra
Diversity of the Parasite Assemblage of Fundu-	Rocky Mountain Acid Deposition Model As-	de l'Estuaire Moyen du Saint-Laurent),
lus zebrinus in the Platte River of Nebraska,	sessment: Evaluation of Mesoscale Acid Deposi-	W89-03133
W89-03062 2H	tion Models for Use in Complex Terrain, W89-02969 5B	
Hyporheic Habitat of River Ecosystems,	W 67-02707	SALINE-FRESHWATER INTERFACES
W89-03122 2E	ROMANIA	Estuarine Fronts,
Madella of Tabl Nilson in Disco Helm the	Isotopic Investigation on the Evolution of	W89-02689 2
Modeling of Total Nitrogen in River Using the Quantity-Quality Model CEQUEAU (Modelisa-	Groundwater Dynamics in the Principal Aquifers in the Southern Dobrudja,	Circulation Anomalies in Tropical Australia
tion de l'Azote Total en Riviere a l'Aide du	W89-02853 2F	Estuaries,
Modele Quantite-Qualite CEQUEAU),		W89-02697 2
W89-03130 5B	Sources of Sediment and Channel Changes in	Hydrogen (H2) Distributions in the Carman
Index of Water Quality Permitting Environmen-	Small Catchments of Romania's Hilly Regions, W89-02896 2J	River Estuary,
tal Follow-up and Assessment of Local Impacts	W 89-02890 2J	W89-03194 2
(Indice de Qualite de l'Eau Permettant le Suivi	Landsliding, Slope Development and Sediment	
Environnemental et la Mesure des Impacts	Yield in a Temperate Environment: Northeast	SALINE WATER Groundwater Resources of Rusk County, Texa
Locaux),	Romania,	
W89-03131 5C	W89-02897 2J	11 07 02 471
Probability and Stochastic Modelling of Water	ROTATING BIOLOGICAL CONTACTOR	SALINE WATER BARRIERS
Quality Parameters in the Thames River,	Stringfellow Leachate Treatment with RBC,	Coastal Lagoons of East Anglia, U.K.,
W89-03135 5B	W89-03328 5D	W89-03184

SALINE WATER INTRUSION

SALINE WATER INTRUSION	and Obion Counties, Tennessee, January-Febru-	SANDFLOAT
Ground Water Contamination from Saltwater Intrusion And Limitations on Agricultural Ac-	ary 1988, W89-02557 5B	Treatment of Farnham and Ashley Reservoir Water by Krofta Sandfloat Process System
tivities,		Project Documentation,
W89-02662 5B	Methods for Collection and Analysis of Aquatic Biological and Microbiological Samples,	W89-02950 5F
Groundwater Flow through a Miliolite Lime-	W89-02568 7B	SANDFLOAT PROCESS
stone Aquifer,		Treatment of Rome Raw Water by Krofta Sand-
W89-03050 2F	Salt Marshes, W89-02762 7B	float Process System Project Documentation (Part A),
SALINE WATER INTRUSIONS	W 89-02/02	W89-02941 5F
Saline Seep on Wheatland in Northwest Oklaho-	Flora and Macrofauna of Intertidal Sediments,	Treatment of Rome Row Water by Vools Sand
ma, W89-02672 5B	W89-02763 2L	Treatment of Rome Raw Water by Krofta Sand- float Process System Project Documentation
	Macrofauna of Subtidal Sediments Using	(Part B),
SALINE WETLANDS Response of Coastal Plants to Increase in Sub-	Remote Sampling,	W89-02942 5F
mergence and Salinity,	W89-02764 2L	Treatment of Rome Raw Water by Krofta Sand-
W89-03188 2L	Processing Sediment Macrofauna Samples,	float Process System - Project Documentation
SALINITY	W89-02765 7B	(Part C), W89-02943 5F
Laguna Madre of Texas: Hydrography of a Hy-	Meiofauna,	W 07-02543
persaline Lagoon,	W89-02766 2L	Treatment of Farnham and Ashley Reservoir
W89-02695 2L		Water by Krofta Sandfloat Process System Final Project Report,
Glacio-Eustatic Sea-Level Control on Red Sea	Subtidal Rock and Shallow Sediments Using	W89-02951 5F
Salinity,	Diving, W89-02768 7B	CANDOTONE
W89-03119 2L	72	SANDSTONE Groundwater Flow in the Navajo Sandstone in
Effects of Temperature, Salinity and Seagrass	Bacteria and Fungi,	Parts of Emery, Grand, Carbon, Wayne, Gar-
Species on the Uptake of Lead(II) from Sea-	W89-02769 7B	field, and Kane Counties, Southeast Utah,
water by Excised Leaves, W89-03275 5B	Plankton,	W89-02521 2F
	W89-02770 2L	SANGAMON RIVER
Iodine Speciation in Chesapeake Bay Waters,	Fish (Survey of),	Assessment of Water Quality and Factors Af
W89-03277 2L	W89-02771 7B	fecting Dissolved Oxygen in the Sangamor River, Decatur to Riverton, Illinois, Summer
SALMON	N 0	1982,
Copper Intoxication in Chinook Salmon (Oncor- hynchus Tshawystscha) Induced by Natural	New System of Seepage Sampling for the Deter- mination of Volatile Organic Substances (Neues	W89-02486 5E
Springwater: Effects on Gill Na(+), K(+)-	System der Sickerwassergewinnung zur Bestim-	SANITARY ENGINEERING
ATPase, and Plasma Glucose,	mung Leichtfluchtiger Organischer Spuren-	Engineering, Mosquitoes and Filariasis: A Case
W89-03228 5C	stoffe),	Report,
Evaluation of the Acute Toxicity to Juvenile	W89-03047 5A	W89-03065 5G
Pacific Salmonids of Hexazinone and its Formu-	Monitoring Baseline Suspended Sediment in	Schistosomiasis Control in Irrigation Schemes in
lated Products: Pronone 10G, Velpar L, and	Forested Basins: The Effects of Sampling on	Zimbabwe,
Their Carriers, W89-03316 5C	Suspended Sediment Rating Curves, W89-03053 2J	W89-03066 50
		SANITARY LANDFILLS
SALT MARSHES Salt Marshes,	SAN ANTONIO REGION	Microbial Activity in Sanitary Landfills: A Pos sible Source of the Humic Substances in
W89-02762 7B	Relation of Water Chemistry of the Edwards Aquifer to Hydrogeology and Land Use, San	Groundwater.
	Antonio Region, Texas,	W89-03079 5E
SALT TOLERANCE Use of Saline Water for Buffalo Gourd Produc-	W89-02514 5B	SANTA CLARA VALLEY
tion in New Mexico,	SAN JOAQUIN VALLEY	Land Subsidence in the Santa Clara Valley, Cali
W89-02475 3C	Land Subsidence in the San Joaquin Valley,	fornia, as of 1982,
SALTS	California, as of 1980,	W89-03019 6C
Relations of Specific Conductance to Stream-	W89-03018 6G	SARAWAK
flow and Selected Water Quality Characteristics	SAN JUAN BASIN	Notes on the Hydrogeological Map of Sarawak
of the Arkansas River Basin, Colorado, W89-02599 2K	Simulating Underground Mines in a Regional	W89-02378
	Model,	SASKATCHEWAN
SAMPLE PREPARATION	W89-02339 4C	Souris River Basin Project, Saskatchewan
Processing Sediment Macrofauna Samples, W89-02765 7B	SAND FILTERS	Canada - North Dakota, U.S.A. General Plan Report and Draft Environmental Impact State
	Treatment of Farnham and Ashley Reservoir	ment.
SAMPLING Innovative Designs for Water Quality Monitor-	Water by Krofta Sandfloat Process System -	W89-02937 8A
ing: Are We Asking the Questions Before the	Project Documentation, W89-02950 5F	SATELLITE TECHNOLOGY
Data Are Collected,		Progression of Regional Snow Melt,
W89-02320 7A	Treatment of Farnham and Ashley Reservoir	W89-02610 20
Design of a Great Lakes Atmospheric Inputs	Water by Krofta Sandfloat Process System Final Project Report,	Snow Cover Record in Eurasia,
and Sources (GLAIS) Network,	W89-02951 5F	W89-02612 20
W89-02418 7A		Distribution of Snow Cover in China,
River Bed Gravels: Sampling and Analysis,	Treatment of Groundwater with Slow Sand Fil- tration,	W89-02613 20
W89-02433 7B	W89-03090 5F	Secure Supraving in County
Bed Load Sampling and Analysis,		Snow Surveying in Canada, W89-02614
W89-02434 2J	SAND STRENGHT	
Quality of Groundwater in Shallow Wells in	Residual Strength of Sand From Dam Failures in the Chilean Earthquake of March 3, 1985,	Northern Hemisphere Snow and Ice Chart of NOAA/NESDIS,
Agricultural Areas of Haywood, Shelby, Lake,	W89-02851 8D	W89-02616 2

NOAA Satellite-Derived Snow Cover Data	Response of Coastal Plants to Increase in Sub-	SEDIMENT CONCENTRATION
Base: Past, Present, and Future,	mergence and Salinity,	Vertical Profiles of Velocity and Suspended
W89-02617 2C	W89-03188 2L	Sediment in Streams near Mount St. Helens,
Snow Cover Data: Status and Future Prospects,	AD 17 15 MA	Washington,
W89-02618 7B	SEALANTS	W89-02523
W 65-02016 /B	Geomembrane Liner Reduces Leakage in Un- derground Reservoir,	SEDIMENT DATA
Comparison of Northern Hemisphere Snow	W89-03281 5F	Sediment-Data Sources and Estimated Annual
Cover Data Sets,		Suspended-Sediment Loads of Rivers and
W89-02619 7C	SEASHORES	Streams in Colorado,
Influence of Snow Structure Variability on	Biological Surveys of Estuaries and Coasts.	W89-02604 2J
Global Snow Depth Measurement using Micro-	W89-02759 7B	SEDIMENT DISCHARGE
wave Radiometry,	Planning Biological Surveys,	Bed Load Discharge Equations for Steep Moun-
W89-02620 7B	W89-02760 7B	tain Rivers,
Retrieval of Snow Water Equivalent from	1107 02100	W89-02445 2J
Nimbus-7 SMMR Data,	Remote Sensing,	Energy Dissipation Rate Approach in River Me-
W89-02621 7B	W89-02761 7B	chanics,
	Salt Marshes,	W89-02453 2J
Nimbus-7 SMMR Snow Cover Data,	W89-02762 7B	Estimates the Tourset and Double of
W89-02622 7C	1107-027-02	Estimating the Transport and Deposition of Mining Waste at Ok Tedi,
Snow Cover Monitoring Using Microwave Ra-	Intertidal Rock,	W89-02461 2J
diometry,	W89-02767 2L	1107-02-01
W89-02623 7B	Diede	Magnitude and Frequency Characteristics of
n	Birds, W89-02772 2L	Suspended Sediment Transport in Devon
Remote Sensing of Snow Properties in Mountainous Terrain,	W 69-02/12	Rivers,
W89-02624 7B	SEASONAL VARIATION	W89-02904 2J
107-02024	Regionalization of Winter Low-flow Character-	SEDIMENT DISCHARGE DATA
Remote Sensing,	istics of Tennessee Streams,	Sediment Discharge Data for the Lower Reach
W89-02761 7B	W89-03005 2E	of Campbell Creek, Anchorage, Alaska: May to
Catallita Bainfall Betsiaval by Logistic Basses	Comparison of Phoenhams Dunamies in Ture	September 1987,
Satellite Rainfall Retrieval by Logistic Regres- sion,	Comparison of Phosphorus Dynamics in Two Oklahoma Reservoirs and a Natural Lake Vary-	W89-02496 2J
W89-02854 7C	ing in Abiogenic Turbidity,	SEDIMENT DISTRIBUTION
	W89-03232 2H	Application of Cs-137 Techniques to Problems
SCOTLAND		of Sediment Redistribution in Sungai Lui Repre-
Stream Response to Flash Floods in Upland	Microflagellate-Picoplankton Food Linkage in	sentative Basin, Selangor, Malaysia: Part I.
Scotland, W89-02912 2E	the Water Column of Lake Biwa,	W89-02712 2J
W 69-02912 ZE	W89-03245 2H	Sediment Transport from Delaware Bay to the
Recent Acidification of a Large Scottish Loch	SEAWATER	New Jersey Inner Shelf,
Located Partly within a National Nature Re-	Glacio-Eustatic Sea-Level Control on Red Sea	W89-03187 21
serve and Site of Special Scientific Interest,	Salinity,	SEDIMENT EROSION
W89-03125 5C	W89-03119 2L	Static Armour Layers by Selective Erosion,
SCOUR	Comparison of the Ecology of Blacktonic Bosto	W89-02439
Blountstown Reach, Apalachicola River, Mova-	Comparison of the Ecology of Planktonic Bacte- ria in Fresh and Salt Water,	,
ble-Bed Model Study,	W89-03258 2H	River Bed Scour and Construction of Stone
W89-02416 2J		Riprap Protection,
Infference Describe Dridge Mountle Ded Model	Forested Wetlands in Freshwater and Salt-	W89-02442 8A
Jefferson Barracks Bridge, Movable-Bed Model Study,	Water Environments,	Extremal Hypotheses Applied to River Regime
W89-02417 2J	W89-03265 2H	W89-02454 2
	SECCHI DISKS	Time Version Stanbartic Model of the Essenan
SCUBA DIVING	Relationships Among Secchi Disk Depth, Beam	Time-Varying Stochastic Model of the Frequen cy and Magnitude of Bed Load Transpor
Subtidal Rock and Shallow Sediments Using	Attenuation Coefficient, and Irradiance Attenu-	Events in Two Small Trout Streams,
Diving, W89-02768 7B	ation Coefficient for Great Lakes Waters,	W89-02459 2
W 65-02706	W89-03176 2H	
SEA GRASSES	Measuring Water Clarity with a Black Disk,	SEDIMENT LOAD Sediment Transport in Gravel-Bed Rivers.
Comparative Ecology of Submersed Grass Beds	W89-03251 7B	W89-02430 2.
in Freshwater, Estuarine, and Marine Environ-	W 65-03231	W 65-02430
ments,	SECONDARY PRODUCTIVITY	Suspended Load in Gravel-Bed Rivers: UK Ex
W89-03264 2H	Secondary Production and Trophic Relation-	perience,
Effects of Temperature, Salinity and Seagrass	ships in a Spring Invertebrate Community,	W89-02452 2
Species on the Uptake of Lead(II) from Sea-	W89-03250 2H	Problems of Bed Load Transport in Braider
water by Excised Leaves,	Comparative Ecology of Submersed Grass Beds	Gravel-Bed Rivers,
W89-03275 5B	in Freshwater, Estuarine, and Marine Environ-	W89-02455 2
SEA ICE	ments,	Case Study of Minimum Streamflow for Fisher
Snow Cover, Cyclogenesis and Cyclone Trajec-	W89-03264 2H	Habitat in the Yampa River,
tories,	material metals and a control	W89-02460 2
W89-02607 2C	Ecological Principles Affecting Community Structure and Secondary Production by Zoo-	
Influence of a Disser Diverse at a Contract	plankton in Marine and Freshwater Environ-	Hydrologic Data for Computation of Sedimer
Influence of a River Plume on the Sea-ice Meio- fauna in South-eastern Hudson Bay,	ments,	Discharge, Toutle and North Fork Toutl Rivers near Mount St. Helens, Washington
W89-03189 2L	W89-03267 2H	1980-84.
		W89-02571 70
SEA LEVEL	SECONDARY WASTEWATER TREATMENT	
Glacio-Eustatic Sea-Level Control on Red Sea	Enhanced Secondary Treatment Incorporating	Bacterial Loadings from Resuspended Sedimen
Salinity, W89-03119 2L	Biological Nutrient Removal, W89-03163 5D	in Recreational Beaches, W89-03136 5

SEDIMENT SAMPLER

SEDIMENT SAMPLER	Problems of Bed Load Transport in Braided	Aggradation and Degradation of Alluvial Sand
Bed Load Transport Measurements by the	Gravel-Bed Rivers, W89-02455 2J	Deposits, 1965 to 1986, Colorado River, Grand Canyon National Park, Arizona,
Vortex-tube Trap on Virginio Creek, Italy, W89-02449 7B	Interaction of Bed Load Transport with Bars,	W89-02973 2J
SEDIMENT TRANSPORT	W89-02456 2J	Sediment Transport Prediction in a Tidal Inlet
Blountstown Reach, Apalachicola River, Mova-		Using a Numerical Model: Application to Stony
ble-Bed Model Study,	Reservoir Sedimentation and Influence of Flush-	Brook Harbor, Long Island, New York, USA,
W89-02416 2J	ing, W89-02457 2J	W89-03185 2J
Sediment Transport in Gravel-Bed Rivers. W89-02430 2J	Design Problems in Gravel-Bed Rivers, Alaska, W89-02458 2J	Sediment Transport from Delaware Bay to the New Jersey Inner Shelf, W89-03187 2J
Differences Between Gravel- and Sand-bed		
Rivers, W89-02431 2J	cy and Magnitude of Bed Load Transport Events in Two Small Trout Streams,	SEDIMENT-WATER INTERFACES Coordination Chemistry at the Solid/Solution
	W89-02459 2J	Interface,
River Dynamics, Flow Regime and Sediment Transport,	Case Study of Minimum Streamflow for Fishery	W89-02642 5B
W89-02432 2J		Prediction of Phosphorus Release Rates from
Sediment Supply to Upland Streams: Influence	W 89-02400 23	Total and Reductant-Soluble Phosphorus in
on Channel Adjustment,	Estimating the Transport and Deposition of	Anoxic Lake Sediments, W89-03210 2H
W89-02435	Mining Waste at Ok Tedi, W89-02461 2J	SEDIMENT YIELD
Sediment Supply, Movement and Storage in an		Transport Processes at the Catchment Scale,
Unstable Gravel-Bed River, W89-02436 2J	Effects of Geology, Runoff, and Land Use on the Stability of the West Gallatin River System,	W89-02437 2J
	Gallatin County, Montana,	Hydrology of Area 8, Eastern Coal Province,
Transport Processes at the Catchment Scale W89-02437		West Virginia and Ohio,
	Hydrologic Data for Computation of Sediment	W89-02598 4C
Sediment Balance Considerations Linking Long-	Discharge, Toutle and North Fork Toutle Rivers near Mount St. Helens, Washington,	Sources of Variation of Soil Erodibility in
Term Transport and Channel Processes, W89-02438	1000 01	Wooded Drainage Basins in Luxembourg,
	W89-02571 7C	W89-02893 2J
Static Armour Layers by Selective Erosion, W89-02439	Sediment-Data Sources and Estimated Annual Suspended-Sediment Loads of Rivers and	Microerosion Processes and Sediment Mobiliza- tion in a Roadbank Gully Catchment in Central
Formation of a Coarse Surface Layer as the	Streams in Colorado,	Oklahoma,
Response to Gravel Mobility,	W89-02604 2J	W89-02894 2J
W89-02440 2.	Application of Cs-137 Techniques to Problems	Water and Sediment Dynamics of the Homerka
Conceptual Models of Sediment Transport in	of Sediment Redistribution in Sungai Lui Repre-	Catchment,
Streams, W89-02443 2.	sentative Basin, Selangor, Malaysia: Part I. W89-02712 2J	W89-02895 2J
W 03-02443		Landsliding, Slope Development and Sediment
Investigation of Sediment Routing by Size Frac	Formulas for Velocity, Sediment Concentration and Suspended Sediment Flux for Steady Uni-	Yield in a Temperate Environment: Northeast
tions in a Gravel-Bed River, W89-02444 2	Directional Pressure-Driven Flow,	Romania, W89-02897 2J
Bad I and Disabana Fountiers for Steen Maur	W89-02779 2J	
Bed Load Discharge Equations for Steep Mountain Rivers,	Dredging: Technology and Environmental As-	SEDIMENTARY ROCK
W89-02445 2	pects. Citations from the Life Sciences Collec-	Development of Groundwater Resources in Sri Lanka,
Field Measurements in a Gravel-bed Rive	tion Database (Jan 78 - Aug 87). W89-02783 2J	W89-02383 4B
which Confirm the Theory of White et al.,	Runoff and Sediment Transport Dynamics in	SEDIMENTATION
W89-02446 2	Canadian Badland Micro-Catchments,	Reservoir Sedimentation and Influence of Flush-
Mountain Torrent Erosion,	W89-02887 2E	ing,
W89-02447	Development of Field Techniques for Assess-	W89-02457 21
Sediment Transport in Step-Pool Streams,	ment of River Erosion and Deposition in Mid-	Consequences of Dredging,
	Wales, UK, W89-02898 2J	W89-02700 2I
Bed Load Transport Measurements by th		Contribution to Computation of Sedimentation
Vortex-tube Transport Measurements by tr	wagintude and Frequency Characteristics of	of Solids in Horizontal-Sedimentation basin
	Suspended Sediment Transport in Devon Rivers,	(Ein Beitrag zur Berechnung der Sedimentation von Feststoffen in Horizontal Durchstromter
Bed Load Transport in Desert Floods: Observ	W89,02904 2T	Sandfangen),
tions in the Negev,	Some Relationships Between Debris Flow	W89-02711 5I
	Motion and Micro-Topography for the Kamika-	Erosion and Sedimentation,
Influence of Large Suspended-Sediment Co	mihori Fan, North Japan Alps, W89-02907 2J	W89-02723 2
centrations in Rivers, W89-02451	2 Precise Measurement of Microforms and Fabric	Martins Fork Lake Sedimentation Study: Hy
	of Alluvial Cones for Prediction of Landform	draulic Model Investigation,
Suspended Load in Gravel-Bed Rivers: UK E	Evolution,	W89-02780 2
perience, W89-02452	W89-02908 2J	I-664 Bridge-Tunnel Study, Virginia Sedimenta
	Analysis of Sediment Transport by Debris	tion and Circulation Investigation,
Energy Dissipation Rate Approach in River M chanics,	the state of the s	W89-02875 4
	W89-02909 2J	Development of Field Techniques for Asses
	Flow Processes and River Channel Morpholo	
Extremal Hypotheses Applied to River Regin W89-02454		Wales, UK,
W 07-02434	2J W89-02910 2.	W89-02898

Suspended Sediment Properties and Their Geo- morphological Significance,	Determination of Evaporation and Seepage Losses, Upper Lake Mary near Flagstaff, Arizo-	SEWER GAS Hydrogen Sulphide Control in Municipal
W89-02899 2J	na, W89-02558 2H	Sewers, W89-02810 5D
Aggradation and Degradation of Alluvial Sand		
Deposits, 1965 to 1986, Colorado River, Grand Canyon National Park, Arizona,	New System of Seepage Sampling for the Deter- mination of Volatile Organic Substances (Neues	SEWER HYDRAULICS Use of Remote Gauging to Measure Sewer
W89-02973 2J	System der Sickerwassergewinnung zur Bestim- mung Leichtfluchtiger Organischer Spuren-	Invert Elevations and Head Loss, W89-03280 5D
Role of Ice in the Morpho-Sedimentologic Regime of a Shoreline in the Middle Saint Law-	stoffe),	
rence Estuary (Le Role des Glaces dans le	W89-03047 5A	SEWER SYSTEM DESIGN Use of Remote Gauging to Measure Sewer
Regime Morpho-Sedimentologique d'un Estran de l'Estuaire Moyen du Saint-Laurent),	SEINE RIVER Oceanographic Characteristics of the Seine Es-	Invert Elevations and Head Loss, W89-03280 5D
W89-03133 2J	tuary, W89-02699 2L	SEWER SYSTEMS
Change in Sedimentation Following River Di- version in the Eastmain Estuary (James Bay),	SEISMOLOGY	Tunnel and Reservoir Plan Solution to Chica-
Canada,	Dynamic Reservoir Interaction with Monticello	go's Combined Sewer Overflow, Basement Flooding, and Pollution,
W89-03186 2J	Dam, W89-02848 8A	W89-03134 4A
Hurricane-Induced Sediment Deposition in a	Seismic Refraction Tests Above Water Table,	SEWERS
Gulf Coast Marsh, W89-03193 2J	W89-03113	Hydrogen Sulphide Control in Municipal Sewers,
SEDIMENTATION RATES	SEMIARID LANDS	W89-02810 5D
Evaluation of Sludge Settleability be Floc Char- acteristics,	Water and Arid Lands of the Western United States.	SHAD
W89-03167 5D	W89-02630 6D	Early Life History and Winter Mortality of Giz-
Change in Sedimentation Following River Di-	West in Profile,	zard Shad in Lake Sharpe, South Dakota, W89-02429 2H
version in the Eastmain Estuary (James Bay),	W89-02631 6D	SHADING
Canada, W89-03186 2J	Great American Desert Transformed: Aridity,	Influence of Nutrient Enrichment and Light
	Exploitation, and Imperialism in the Making of the Modern American West,	Availability on the Abundance of Aquatic Ma-
SEDIMENTS Hydrogeological Mapping in the Philippines,	W89-02632 6D	crophytes in Florida Streams, W89-03231 5C
W89-02382 2F	Growth and Water in the South Coast Basin of	
Biogeochemistry of Lead-210 and Polonium-210	California,	SHALLOW WATER Dispersion in Shallow Estuaries,
in Fresh Waters and Sediments,	W89-02636 6D	W89-02685 2L
W89-02555 2K	New Water Policies for the West, W89-02639 6D	SHELLS
Partitioning of Trace Metals in Sediments, W89-02649 5B		Clam Shell Dredging in Lakes Pontchartrain
	SEOUL Treatment of Potable Water from Seoul, Korea	and Maurepas, Louisiana, W89-02715 6G
Trace Metal Speciation in Sediments and Soils: An Overview from a Water Industry Perspec-	by Flotation, Filtration and Adsorption, W89-03319 5F	SIERRA NEVADA
tive, W89-02651 5B	SEPARATION TECHNIQUES	Diagnostic Technique for Targeting during Air- borne Seeding Experiments in Wintertime
	Separators and Emulsion Separation Systems for	Storms over the Sierra Nevada,
Distribution of Gamma-emitting Radionuclides in Surface Subtidal Sediments Near the Sella-	Petroleum, Oil, and Lubricants, W89-02808 5D	W89-03305 2B
field Plant, W89-03190 5B	Continuous Flow Determination of Carbon Di-	SILICA
Hexachlorophene Distributions in Estuarine	oxide in Water by Membrane Separation-Chemi-	Silica and Phosphorus Flux from Sediments: Im- portance of Internal Recycling in Lake Michi-
Sediments,	luminescent Detection, W89-03182 7B	gan, W89-03219 2H
W89-03196 5B		
DDT Residues in Sediments from the Bay of	Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale,	Dynamics of Lake Michigan Phytoplankton: Re- lationship to Nitrogen and Silica Fluxes,
Bengal, W89-03198 5B	W89-03301 5A	W89-03230 2H
Chronic Effects of Contaminated Sediment on	SETO INLAND SEA	SILTING
Daphnia magna and Chironomus tentans,	Mass Balance of Heavy Metals in the Seto Inland Sea, Japan,	Reservoir Sedimentation and Influence of Flush-
W89-03312 5C	W89-03278 5B	ing, W89-02457 2J
SEED DISPERSAL	SETTLING BASINS	Maria Fal Iala Calimantaian Studen Un
Hydrochory and Regeneration in a Bald Cy- press-Water Tupelo Swamp Forest,	Contribution to Computation of Sedimentation of Solids in Horizontal-Sedimentation basins	draulic Model Investigation,
W89-03295 2H	(Ein Beitrag zur Berechnung der Sedimentation	W89-02780 2J
SEEDS	von Feststoffen in Horizontal Durchstromten Sandfangen),	Interstitial Water Quality of Lake Trout Spawn-
Role of the Seed Bank in the Development of Vegetation on a Freshwater Marsh Created	W89-02711 5D	ing Habitat, W89-03172 5C
from Dredge Spoil, W89-03169 2H	Assimilative Capabilities of Retention Ponds, W89-02856 5D	Comparison of Phosphorus Dynamics in Two Oklahoma Reservoirs and a Natural Lake Vary-
Hydrochory and Regeneration in a Bald Cy-	SETTLING TANKS	ing in Abiogenic Turbidity,
press-Water Tupelo Swamp Forest,	Experimental Study of Flow in Settling Tanks,	W89-03232 2H
W89-03295 2H	W89-03107 8B	SIMULATED RAINFALL
SEEPAGE Seepage Study of A 153 Mile Section of the	SEWAGE DISPOSAL Contribution of Toxic Chemicals to Groundwat-	Runoff Characteristics and Washoff Loads from Rainfall-Simulation Experiments on a Street Sur-
Seepage Study of A 15.3 Mile Section of the Central Utah Canal, Pahvant Valley, Millard	er for Domestic On-Site Sewage Disposal Sys-	face and a Native Pasture in the Denver Metro-
County, Utah,	tems,	politan Area, Colorado,
W89-02469 2E	W89-02584 5B	**************************************

2E

2E

SIMULATION

IMULATION	Municipal Wastewater Sludge Combustion	SNOW COLLECTORS
Simulation of Flood Hydrographs for Georgia Streams,	Technology. W89-02872 5D	Development and Field Use of a Snow Collec- tor for Acid Precipitation Studies,
W89-03002 5E	Evaluation of Sludge Settleability be Floc Char-	W89-02945 5B
Model Calibration Based on Random Environ-	acteristics.	SNOW COVER
mental Fluctuations,	W89-03167 5D	Snow Watch '85.
W89-03105 7A	SLUDGE CONDITIONING	W89-02606 2C
Simulations of Physical Nonequilibrium Solute	Metal Treatment and Recovery,	Snow Cover, Cyclogenesis and Cyclone Trajec-
Transport Models: Application to a Large-Scale Field Experiment.	W89-02653 5D	tories,
W89-03148 2F	Reuse of Chemical Sludge for Conditioning of Biological Sludges,	W89-02607 2C
IMULATION ANALYSIS	W89-02815 5D	Relationships between Snow Cover and Tem-
Techniques for Estimating Regional Flood	OF LIBCE DIGERMON	perature in the Lower Troposphere, General Circulation in East Asia and Precipitation in
Characteristics of Small Rural Watersheds in the	SLUDGE DIGESTION Bacterial Leaching of Heavy Metals from An-	China,
Plains Region of Eastern Colorado, W89-02507 2E	aerobically Digested Sludge,	W89-02609 2C
	W89-02925 5D	Progression of Regional Snow Melt,
Microcomputer Program Development for On- Farm Irrigation Systems Planning,	SLUDGE DISPOSAL	W89-02610 2C
W89-02550 6A	Use and Disposal of Municipal Wastewater	0 . C . A . C . T . T . C . T
	Sludge. W89-02834 5E	Soot from Arctic Haze: Radiative Effects on the Arctic Snowpack,
Consideration of Dimensional Dependence in Modelling the Structure of Flow Zones within		W89-02611 2C
the Subsurface,	Pilot Scale Evaluation of Sludge Landfilling:	
W89-02551 5B	Four Years of Operation, W89-02978 5E	Snow Cover Record in Eurasia, W89-02612 2C
Interactive Simulation of Chemical Movement		
in Soil,	SLUDGE DRYING	Distribution of Snow Cover in China,
W89-02675 5B	Treatment of Filter Effluents from Dewatering of Sludges by a New High Performance Floccu-	W89-02613 2C
Processes, Coefficients, and Models for Simulat-	lation Reactor,	Snow Surveying in Canada,
ing Toxic Organics and Heavy Metals in Surface	W89-02819 5D	W89-02614 7B
Waters, W89-02788 5B	Belt Filter Press Dewatering of Wastewater	Snow Cover in Real Time Monitoring,
	Sludge.	W89-02615 2C
Use of Linear Compartmental Simulation Ap-	W89-03099 5D	Northern Hemisphere Snow and Ice Chart of
proach for Quantitative Interpretation of Isotope Data under Time Variant Flow Conditions,	SLUDGE UTILIZATION	NOAA/NESDIS,
W89-03017 7C	Composting of Municipal Wastewater Sludges.	W89-02616 2C
Sediment Record of Biogeochemical Responses	W89-02855 5D	NOAA Satellite-Derived Snow Cover Data
to Anthropogenic Perturbations of Nutrient	Aerobic Treatment of Sewage from Lignite	Base: Past, Present, and Future,
Cycles in Lake Ontario,	(Brown Coal) Processing, W89-02915 5D	W89-02617 2C
W89-03222 2H	W89-02913	Snow Cover Data: Status and Future Prospects,
SINKS	Bacterial Leaching of Heavy Metals from An-	W89-02618 7B
New Directions in Karst.	aerobically Digested Sludge, W89-02925 5D	
W89-02728 2F		Comparison of Northern Hemisphere Snow Cover Data Sets,
SLOPES	Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Perform-	W89-02619 7C
Controls on Overland Flow Generation, W89-02882 2E	ance of their Offspring,	I G C V V V
	W89-03061 5E	Influence of Snow Structure Variability on Global Snow Depth Measurement using Micro-
Hydrochemical Characteristics of a Dartmoor	SLUDGE VOLUME INDEX	wave Radiometry,
Hillslope, W89-02903 2E	Evaluation of Sludge Settleability be Floc Char-	W89-02620 7B
	acteristics,	Retrieval of Snow Water Equivalent from
Patterns of Hillslope Solutional Denudation in Relation to the Spatial Distribution of Soil Mois-	W89-03167 5D	Nimbus-7 SMMR Data,
ture and Soil Chemistry over a Hillslope Hollow	SMALL WATERSHEDS	W89-02621 7E
and Spur,	Techniques for Estimating Regional Flood	Nimbus-7 SMMR Snow Cover Data,
W89-02906 2J	Characteristics of Small Rural Watersheds in the Plains Region of Eastern Colorado,	W89-02622 7C
SLUDGE	W89-02507 2E	Snow Cours Monitoring Using Microwaya Po
Pilot Scale Results of Metal Value Recovery	Some Indications of Small Catalanant Solute	Snow Cover Monitoring Using Microwave Ra- diometry.
from Mixed Metal Hydroxide Sludges, W89-02394 5D	Some Implications of Small Catchment Solute Studies for Geomorphological Research,	W89-02623 7E
	W89-02902 2E	Remote Sensing of Snow Properties in Moun
Plating Waste Sludge Metal Recovery, W89-02395 5D	SNAILS	tainous Terrain,
W89-02395 5D	Impairment of Mobility and Development in	W89-02624 7E
Regulation of the Agricultural Utilization of	Freshwater Snails (Physa fontinalis and Lym-	Effects of Snow Cover and Tropical Forcing or
Sewage Sludge in New Jersey, W89-02676 5E	naea stagnalis) Caused By Herbicides, W89-03290 5C	Mid-Latitude Monthly Mean Circulation,
		W89-02625 20
Influence of Sludge from Chemical Biological	SNOW	Parameterization of Snow Albedo for Climate
Wastewater Treatment on Nitrification and Di- gestion,	Snow and Ice, W89-02722 2C	Models,
W89-02816 5D		W89-02626 70
Heavy Metal Removal from Sewage Sludge:	Development and Field Use of a Snow Collec- tor for Acid Precipitation Studies,	Modelling a Seasonal Snow Cover,
Practical Experiences with Acid Treatment,	W89-02945 5B	W89-02627 20
W89-02818 5D		
Composting of Municipal Wastewater Sludges.	Modelling Seasonally Freezing Ground Condi- tions,	Characteristics of Seasonal Snow Cover as Simulated by GFDL Climate Models,
W89-02855 5D	W89-03331 2C	W89-02628 20

CO2-Induced Changes in Seasonal Snow Cover Simulated by the OSU Coupled Atmospheric- Ocean General Circulation Model,	Soil Testing As a Guide to Prudent Use of Nitrogen Fertilizers in Oklahoma Agriculture, W89-02664 7B	SOIL DYNAMICS Spatial Variability of Soil Hydrodynamic Properties in the Petite Fecht Catchment, Soultzeren,
W89-02629 2C		France - Preliminary Results,
Eurasian Snow Cover and Seasonal Forecast of	Interactive Simulation of Chemical Movement in Soil,	W89-02883 2G
Indian Summer Monsoon Rainfall,	W89-02675 5B	SOIL EROSION
W89-03054 2B	Hydrology and Solute Uptake in Hillslope Soils	Limestone Weathering Under a Soil Cover and the Evolution of Limestone Pavements, Malham
Modelling Seasonally Freezing Ground Condi- tions,	on Magnesian Limestone: the Whitwell Wood Project,	District, North Yorkshire, UK,
W89-03331 2C	W89-02891 2G	W89-02740 2J
SNOW DEPTH	Patterns of Hillslope Solutional Denudation in	Kamenitzas of Gait Barrows National Nature Reserve, North Lancashire, England,
Distribution of Snow Cover in China, W89-02613 2C	Relation to the Spatial Distribution of Soil Mois- ture and Soil Chemistry over a Hillslope Hollow	W89-02741 2F
Influence of Snow Structure Variability on	and Spur, W89-02906 2J	Pipeflow and Pipe Erosion in the Maesnant Ex-
Global Snow Depth Measurement using Micro-		perimental Catchment, W89-02884 2E
wave Radiometry, W89-02620 7B	Interactions of Organic Matter and Aluminum Ions in Acid Forest Soil Solutions: Metal Com-	
	plexation, Flocculation, and Precipitation,	Runoff and Sediment Transport Dynamics in Canadian Badland Micro-Catchments.
SNOW MELT	W89-03126 2K	W89-02887 2E
Modelling a Seasonal Snow Cover, W89-02627 2C	SOIL COMPOSITION	Sources of Variation of Soil Erodibility in
SNOW PACK	Behaviour of Buried Small Flexible Pipes, W89-03137 8G	Wooded Drainage Basins in Luxembourg,
Nimbus-7 SMMR Snow Cover Data,	SOIL CONTAMINATION	W89-02893 2J
W89-02622 7C	Air Pollution and Soil Acidification,	Water and Sediment Dynamics of the Homerka
Remote Sensing of Snow Properties in Moun-	W89-02306 5B	Catchment, W89-02895 2J
tainous Terrain,	Discussion of the Changes in Soil Acidity Due	
W89-02624 7B	to Natural Processes and Acid Deposition,	Sources of Sediment and Channel Changes in Small Catchments of Romania's Hilly Regions,
Parameterization of Snow Albedo for Climate	W89-02307 5B	W89-02896 2J
Models, W89-02626 7C	Soil Acidification and Metal Solubility in For-	SOIL FUNGI
	ests of Southern Sweden, W89-02308 5B	Effects of Ozone and Acid Rain on White Pine
SNOWMELT Progression of Regional Snow Melt,	Differences in Aluminum Mobilization in Spodo-	(Pinus strobus) Seedlings Grown in Five Soils: II. Mycorrhizal Infection.
W89-02610 2C	sols in New Hampshire (USA) and in the Neth-	W89-03057 5C
SNOWPACK	erlands as a Result of Acid Deposition,	SOIL MECHANICS
Influence of Snow Structure Variability on	W89-02309 5B	Influence of Ground Water on Soil-Structure
Global Snow Depth Measurement using Micro- wave Radiometry,	Natural and Anthropogenic Acidification of Peatlands,	Interaction,
W89-02620 7B	W89-02311 5B	W89-02850 2F
SOCIAL ASPECTS	Quantitative Studies of Biodegradation of Petro-	Residual Strength of Sand From Dam Failures
Social Choice and Benefit-Cost Analysis,	leum And Some Model Hydrocarbons in	in the Chilean Earthquake of March 3, 1985, W89-02851 8D
W89-02756 6B	Ground Water and Sediment Environments, W89-02674 5B	SOIL PROPERTIES
SODIUM ALUMINATE		Influence of Ground Water on Soil-Structure
Evaluation of Sodium Aluminate as a Coagulant for Cost Savings at Water Treatment Plants,	Literature Study on the Feasibility of Microbio- logical Decontamination of Polluted Soils,	Interaction, W89-02850 2F
W89-02959 5F	W89-02916 5G	W89-02850 2F
SOIL ABSORPTION CAPACITY	In Situ Biological Treatment of Hazardous	SOIL SATURATION
Limits on Cation Leaching of Weakly Podzo-	Waste-Contaminated Soils,	Seismic Refraction Tests Above Water Table, W89-03113 7A
lized Forest Soils: An Empirical Evaluation, W89-02310 5B	W89-02923 5D	
	Critique of Models for Freshwater and Soil	SOIL SOLUTION Patterns of Hillslope Solutional Denudation in
SOIL CHEMISTRY Air Pollution and Soil Acidification,	Acidification, W89-02967 5B	Relation to the Spatial Distribution of Soil Mois-
W89-02306 5B		ture and Soil Chemistry over a Hillslope Hollow and Spur,
Discussion of the Changes in Soil Acidity Due	Superfund Record of Decision: Kane and Lom- bard, MD.	W89-02906 2J
to Natural Processes and Acid Deposition,	W89-02977 · 5E	SOIL STRENGHT
W89-02307 5B	Sensitivity Analysis of Adsorption and Degrada-	Residual Strength of Sand From Dam Failures
Soil Acidification and Metal Solubility in For-	tion Parameters in the Modeling of Pesticide	in the Chilean Earthquake of March 3, 1985, W89-02851 8D
ests of Southern Sweden, W89-02308 5B	Transport in Soils, W89-03150 2G	
	Solute Transport Modeling in Heterogeneous	SOIL TEMPERATURE Model for Predicting the Effect of Drainage on
Limits on Cation Leaching of Weakly Podzo- lized Forest Soils: An Empirical Evaluation,	Soils: Conjunctive Application of Physically	Soil Moisture, Soil Temperature and Crop Yield,
W89-02310 5B	Based and System Approaches,	W89-03334 4A
Natural and Anthropogenic Acidification of	W89-03151 2G	SOIL TESTS
Peatlands,	Biological Transformation and Detoxification of	Soil Testing As a Guide to Prudent Use of Nitrogen Fertilizers in Oklahoma Agriculture,
W89-02311 5B	7,12-Dimethylbenz(a)anthracene in Soil Systems, W89-03161 5B	
Interactions of Sphagnum with Water and Air,	SOIL CREEP	SOIL TYPES
W89-02312 2H	Relationship Between Soil Creep Rate and Cer-	Effects of Ozone and Acid Rain on White Pine
Proton Cycling in Bogs: Geographical Variation in Northeastern North America,	tain Controlling Variables in a Catchment in Upper Weardale, Northern England,	(Pinus strobus) Seedlings Grown in Five Soils: III. Nutrient Relations,
W89-02316 5B		

5C

SOIL WATER

OIL WATER	SOLUTE 'SOIL WATER	SOUTH AFRICA
Recognizing Petroleum Hydrocarbon Contami-	Hydrology and Solute Uptake in Hillslope Soils	Ecological Research on South African Rivers -
nation in the Vadose Zone with Photoionization	on Magnesian Limestone: the Whitwell Wood	A Preliminary Synthesis,
Detection Scanning of Field Samples,	Project,	W89-02982 2H
W89-02351 5A	W89-02891 2G	C
Influence of Ground Water on Soil Structure	COLUTE TRANSPORT	Conservation of South African Rivers,
Influence of Ground Water on Soil-Structure	SOLUTE TRANSPORT	W89-02985 . 2H
Interaction, W89-02850 2F	Field Simulation of Waste Impoundment Seep-	Pii F
W89-02850 2F	age in the Vadose Zone,	Riverine Ecosystems,
Spatial Variability of Soil Hydrodynamic Prop-	W89-02348 5B	W89-02986 2H
erties in the Petite Fecht Catchment, Soultzeren,	Predicting Chemical Movement in Soils,	Conservation Aims, Criteria, and Goals for
France - Preliminary Results,	W89-02473 5B	
W89-02883 2G	W 07-02473 3B	Rivers,
7702005	Analytically-Derived Sensitivities in One-Di-	W89-02987 2H
Dynamics of Water Chemistry in Hardwood and	mensional Models of Solute Transport in Porous	Here of and Hamon Immed on Discon
Pine Ecosystems,	Media.	Uses of, and Human Impact on Rivers,
W89-02900 2K	W89-02595 5B	W89-02988 4C
	W 67-02373	Conservation Management Options for Rivers,
Relationship Between Soil Creep Rate and Cer-	Rapid Subsurface Flow and Streamflow Solute	
tain Controlling Variables in a Catchment in	Losses in a Mixed Evergreen Forest, New Zea-	W89-02989 6A
Upper Weardale, Northern England,	land,	River Response to Catchment Conditions,
W89-02905 2J	W89-02890 2G	W89-02990 2H
		W89-02990 2H
Patterns of Hillslope Solutional Denudation in	Variable Solute Sources and Hydrological Path-	Monitoring and Surveillance,
Relation to the Spatial Distribution of Soil Mois-	ways in a Coastal Subalpine Environment,	W89-02991 7B
ture and Soil Chemistry over a Hillslope Hollow	W89-02901 2K	W 89-02991 /B
and Spur,		River Conservation - Implications for Legisla-
W89-02906 2J	Solute Transport in Fractured Rocks,	tion,
2.1 CT 2. C M. LT C 2.1 W	W89-03014 2F	W89-02992 6E
Role of Tracer Data for Modeling Soil-Water		W 89-02992 0E
Flow in the Unsaturated Zone,	Simulations of Physical Nonequilibrium Solute	Research and Information Needs,
W89-03013 2G	Transport Models: Application to a Large-Scale	W89-02993 2H
Responses of Four Irish Wetland Tree Species	Field Experiment,	W 07-02773
to Raised Soil Water Levels,	W89-03148 , 2F	SOUTH CAROLINA
W89-03128 2H		Summary of the Hydrology of the Floridan Aq-
W89-03128 2f1	Sensitivity Analysis of Adsorption and Degrada-	uifer System in Florida and in Parts of Georgia,
Influence of Potential Evaporation on the Varia-	tion Parameters in the Modeling of Pesticide	South Carolina, and Alabama,
bilities of Simulated Soil Wetness and Climate,	Transport in Soils,	
W89-03308 2D	W89-03150 2G	W89-03034 2F
1107-03300	Saluta Transport Madalina in Matanaganana	SOUTH DAKOTA
Model for Predicting the Effect of Drainage on	Solute Transport Modeling in Heterogeneous	Water Resources of Walworth County, South
Soil Moisture, Soil Temperature and Crop Yield,	Soils: Conjunctive Application of Physically	
W89-03334 4A	Based and System Approaches,	Dakota,
	W89-03151 2G	W89-02489 2F
SOIL-WATER-PLANT RELATIONSHIPS	SOLUTES	Designed Asses in the James Pivos Perin in
Metal Speciation and Interactions among Ele-		Drainage Areas in the James River Basin in Eastern South Dakota,
ments Affect Trace Element Transfer in Agri-	Some Implications of Small Catchment Solute	
cultural and Environmental Food-Chains,	Studies for Geomorphological Research,	W89-02515 7C
W89-02650 5B	W89-02902 2E	Summary of the High Plains Pagional Aquifar
	SOLVENTS	Summary of the High Plains Regional Aquifer-
Trace Metal Speciation in Sediments and Soils:		System Analysis in Parts of Colorado, Kansas,
An Overview from a Water Industry Perspec-	Successful In House Recovery of Solvent,	Nebraska, New Mexico, Oklahoma, South
tive,	W89-02410 5G	Dakota, Texas, and Wyoming,
W89-02651 5B	Waste Minimization Audit Report: Case Studies	W89-03030 2F
	of Minimization of Solvent Wastes and Electro-	FOR A OF FINE CONTRACTOR DESCRIPTION
Dynamics of Water Chemistry in Hardwood and	plating Wastes at a DOD (Department of De-	Effects of Future Ground-Water Pumpage on
Pine Ecosystems,	fense) Installation,	the High Plains Aquifer in Parts of Colorado,
W89-02900 2K		Kansas, Nebraska, New Mexico, Oklahoma,
	W89-02839 5D	South Dakota, Texas, and Wyoming,
Variable Solute Sources and Hydrological Path-	SOOT	W89-03031 2F
ways in a Coastal Subalpine Environment,	Soot from Arctic Haze: Radiative Effects on the	Desired Assistance VI Latin A 27 of
W89-02901 2K	Arctic Snowpack,	Regional Aquifer System Underlying the North
SOIL WATER POLLUTION	W89-02611 2C	ern Great Plains in Parts of Montana, North
	11 07-02011	Dakota, South Dakota, and Wyoming: Summa-
Modeling of Polychlorinated Biphenyls in	SORPTION	ry,
Vadose Zone,	Groundwater Protection by Accelerated Testing	W89-03033 2F
W89-02353 5B	of Organic Chemical Breakthroughs of Soil Bar-	COLUMN DI ATTE DIVIND
SOIL WATERS	riers,	SOUTH PLATTE RIVER
	W89-02585 5A	Conjunctive Use of Surface and Ground Water
Variable Solute Sources and Hydrological Path-	11 07-02303 JA	in the South Platte, River Basin: A Case Study
ways in a Coastal Subalpine Environment, W89-02901 2K	Influence of Cosolvents on Quinoline Sorption	of the Central Colorado Water Conservancy
W89-02901 2K	by Subsurface Materials and Clays,	District,
SOLID WASTE DISPOSAL	W89-03040 5B	W89-02659 6D
Evaluation of Municipal Solid Waste Landfill		
Cover Designs.	Kinetic Control of Dissolved Phosphate in Natu-	SOUTH PLATTE RIVER BASIN
W89-02871 5E	17: 17: 17: 17: 17: 17: 17:	Hydrology of Area 59, Northern Great Plain
3E	phate Buffer Mechanism,	and Rocky Mountain Coal Provinces, Colorado
SOLID WASTES	W89-03253 2K	and Wyoming,
Corrective Measures for Releases to Ground-		W89-02501 2E
water from Solid Waste Management Units.	SOURIS RIVER	
W89-02844 5G	Souris River Basin Project, Saskatchewan,	SOUTHEASTERN COASTAL PLAIN AQUIFER
	Canada - North Dakota, U.S.A. General Plan	Configuration and Hydrology of the Pre-Creta
SOLOMON ISLANDS	Report and Draft Environmental Impact State-	ceous Rocks Underlying the Southeastern Coast
Position Paper: Solomon Islands,	ment.	al Plain Aquifer System,
W89-02367 2F		W89-03007 21

2F

SPACE SHUTTLE	Inductively Coupled Plasma-Mass Spectrome-	ST. LAWRENCE RIVER
Evaluation of Rain Chemistry Data for the John F. Kennedy Space Center, Florida and the Uni-	try, W89-03303 5A	Above- and Below-Ground Macrophyte Pro- duction in Scirpus Tidal Marshes of the St.
versity of Central Florida, Orlando, Florida, W89-02708 4C	SPENT PULPING LIQUORS	Lawrence Estuary, Quebec,
	Syntrophic Bacteria Process to Convert a Pulp	W89-03055 2L
SPAIN	Mill's Spent Sulphite Liquor to Hydrogen Sul-	STABILITY
Effects of Hydroelectric Scheme on Fluvial Ecosystems within the Spanish Pyrenees,	phide, W89-03115 5D	Effects of Geology, Runoff, and Land Use on
W89-03138 6G		the Stability of the West Gallatin River System, Gallatin County, Montana,
Estimate of Precipitation Enhancement Potential	SPHAGNUM	W89-02472 4C
for the Duero Basin of Spain,	Interactions of Sphagnum with Water and Air, W89-02312 2H	
W89-03306 3B	W09-02312 211	STABILITY ANALYSIS
SPAWNING	Acidification and Succession in a Flood-Plain	Analysis of Bank Stability in the DEC Water- sheds, Mississippi,
Biology of the Walleye in Lake Sharpe, South	Mire in the Norfolk Broadland, U.K., W89-03123 2H	W89-02825 4D
Dakota, 1964-1975,	W 67-03123	
W89-02427 2H	SPILLWAY GATES	STANDARDS
Interstitial Water Quality of Lake Trout Spawn-	Vibration and Leakage of Weir Gates, W89-03073 8C	International Legend for Hydrogeological Maps: Principles and Application,
ing Habitat, W89-03172 5C	W 69-030/3	W89-02386 7B
	SPILLWAYS	
SPECIATION	Air Demand and Conduit Pressures, Stillhouse	Data Requirements for Hydrogeological Maps,
Iodine Speciation in Chesapeake Bay Waters,	Hollow Dam, Lampasas River, Texas, W89-02415 8B	W89-02387 7A
W89-03277 2L	110702413	Hydrogeological Mapping in Coastal Areas,
SPECIES DIVERSITY	SPIRIT LAKE	W89-02390 2F
Modification and Assessment of an Index of Biotic Integrity to Quantify Stream Quality in	Spirit Lake, Mount St. Helens, Washington, Limnological and Bacteriological Investigations.	Supplemental Final Development Document for
Southern Ontario.	Final Report, Volume I,	Effluent Limitations Guidelines, New Source
W89-03211 4C	W89-02709 2H	Performance Standards and Pretreatment Stand-
Correspondence Between Ecoregions and Spa-	Saint Labo Mount St. Holon Washington	ards for the Leather Tanning and Finishing
tial Patterns in Stream Ecosystems in Oregon,	Spirit Lake, Mount St. Helens, Washington, Limnological and Bacteriological Investigations.	Point Source Category.
W89-03223 2H	Final Report, Volume II, Appendices,	W89-02832 6E
SPECIFIC CONDUCTANCE	W89-02710 2H	Analysis of Biomonitoring Techniques to Sup-
Results of Intercomparison Studies for the Meas-	SPODOSOLS	plement Effluent Guidelines.
urements of pH and Specific Conductance at	Differences in Aluminum Mobilization in Spodo-	W89-02994 5A
National Atmospheric Deposition Program/Na-	sols in New Hampshire (USA) and in the Neth-	STATE JURISDICTION
tional Trends Network Monitoring Sites, Octo- ber 1981-October 1985,	erlands as a Result of Acid Deposition,	Developing a State Ground Water Policy in the
W89-02485 5A	W89-02309 5B	Corn Belt: the Iowa Case,
	SPOIL BANKS	W89-02681 2F
SPECIFIC CONDUCTIVITY Relations of Specific Conductance to Stream-	Role of the Seed Bank in the Development of	STATISTICAL ANALYSIS
flow and Selected Water Quality Characteristics	Vegetation on a Freshwater Marsh Created from Dredge Spoil,	Estimating Generalized Skew of the Log-Pear-
of the Arkansas River Basin, Colorado,	W89-03169 2H	son Type III Distribution for Annual Peak
W89-02599 2K	CRAIN EXCENSIVE	Floods in Illinois, W89-03006 2E
SPECTROMETRY	SPOIL DISPOSAL Dredging: Technology and Environmental As-	W89-03006 2E
Determination of Metals with ICP-AES in Com-	pects. Citations from the Life Sciences Collec-	Nonparametric Evaluation of the Size of Limno
parison to the AAS, Photometry, and Millival- Balance of the Anions (Die Metallbestimmung	tion Database (Jan 78 - Aug 87).	logical Sampling Networks: Application to the
mit der ICP-AES im Vergleich zur AAS, Pho-	W89-02783 . 2J	Design of a Survey of Green Bay, W89-03174 7A
tometrie und Anionen-Millival-Bilanz),	SPRINGS	W 65-031/4
W89-03048 5A	Karst Water Temperature and the Shaping of	Probability Distribution for Critical DO Loca
Determination of Traces of Thallium in Various	Malham Cove, Yorkshire,	tion in Streams,
Matrices,	W89-02737 2F	W89-03292 7E
W89-03067 5A	Secondary Production and Trophic Relation-	STATISTICAL METHODS
SPECTROPHOTOMETRY	ships in a Spring Invertebrate Community,	Development of Estimation Methods for Tribu
Comparative Study of Different Techniques for	W89-03250 2H	tary Loading Rates of Toxic Chemicals, W89-02547
Nitrate Determination in Environmental Water	SQUALLS	W89-02547 51
Samples, W89-03302 5A	Relationship of Surface Pressure Features to the	
	Precipitation and Airflow Structure of an In- tense Midlatitude Squall Line,	logical Sampling Networks: Application to the
SPECTROSCOPY Ultra-Trace-Level Determination of Cobalt,	W89-03274 2B	Design of a Survey of Green Bay, W89-03174 7A
Chromium, and Hydrogen Peroxide by Luminol		W89-03174
Chemiluminescence Detected With a Charge-	SRI LANKA Development of Groundwater Resources in Sri	STATISTICAL MODELS
Coupled Device,	Lanka,	Satellite Railian Retrieval by Logistic Regien
W89-03181 7B	W89-02383 4B	sion, W89-02854
Continuous Flow Determination of Carbon Di-	ST ATRANS BAV	W89-02854 76
oxide in Water by Membrane Separation-Chemi-	ST. ALBANS BAY Analysis of Agricultural Nonpoint Pollution	STATISTICAL STUDIES
luminescent Detection, W89-03182 7B	Control Options in the St. Albans Bay Water-	Application of Statistical Process Control t
	shed,	Wastewater Pretreatment, W89-02404 51
Xanthene Dye Chemiluminescence for Determi-	W89-02419 5G	W89-02404 51
nation of Free Chlorine in Water, W89-03183 7B	ST. LAWRENCE	STATISTICS
	Physical Oceanography of the St. Lawrence Es-	
Determination of Tin in Environmental Samples	tuary,	spective, W89-02318 5
by Graphite Furnace Atomic Absorption and	W89-02698 2L	W89-02318 5

STATISTICS

Statistical Analyses of Flood Frequency, Low-	STREAM BANKS Definite Project Report for Section 14. Emer-	flow, Water Quality, and Water-Supply Oper- ations in a River Basin,
Flow Frequency and Flow Duration of Streams in the Philadelphia Area, Pennsylvania,	gency Streambank Protection, Sangamon River	W89-02600 7C
W89-02492 2E	Sewage Treatment Facility, Riverton, Illinois.	A
TILLHOUSE HOLLOW DAM Air Demand and Conduit Pressures, Stillhouse	W89-02934 4D STREAM BIOTA	Annual Yield and Selected Hydrologic Data for the Arkansas River Basin Compact, Arkansas- Oklahoma, 1987 Water Year,
Hollow Dam, Lampasas River, Texas, W89-02415 8B	Modification and Assessment of an Index of Biotic Integrity to Quantify Stream Quality in	W89-02602 2E
TOCHASTIC MODELS	Southern Ontario, W89-03211 4C	Pre-Feasibility on Streamflow Gauging Using Radioisotope Tracer Method for Kemumbu Ag-
Stochastic Modelling of Rainfall Occurrences in Continuous Time,	Hydrologic and Riparian Influences on the	riculture Development Authority (KADA), W89-02713 2E
W89-03049 2B	Import and Storage of Coarse Particulate Or- ganic Matter in a Prairie Stream,	
TOCHASTIC PROCESS Time-Varying Stochastic Model of the Frequen-	W89-03214 2H	Flow Processes and River Channel Morpholo- gy,
cy and Magnitude of Bed Load Transport Events in Two Small Trout Streams,	Correspondence Between Ecoregions and Spa- tial Patterns in Stream Ecosystems in Oregon,	W89-02910 2J
W89-02459 2J	W89-03223 2H	Natural Flow and Water Consumption in the
TORM RUNOFF	Influence of Nutrient Enrichment and Light	Milk River Basin, Montana and Alberta, Canada, W89-03004 2E
Techniques for Estimating Regional Flood Characteristics of Small Rural Watersheds in the	Availability on the Abundance of Aquatic Ma- crophytes in Florida Streams,	Regionalization of Winter Low-flow Character-
Plains Region of Eastern Colorado, W89-02507 2E	W89-03231 5C	istics of Tennessee Streams,
	STREAM DEGRADATION	W89-03005 2E
U.S. Geological Survey Urban-Stormwater Data Base of Constituent Storm Loads; Characteris-	Investigation of Sediment Routing by Size Frac- tions in a Gravel-Bed River,	Hydrologic Design Methodologies for Prefeasi-
tics of Rainfall, Runoff, and Antecedent Conditions; and Basin Characteristics,	W89-02444 2J	bility Studies of Small-Scale Hydro at Ungauged Sites,
W89-02581 7C	STREAM DISCHARGE Rainfall-Runoff Data for Somerset County, New	W89-03129 7A
Rainfall-Runoff Data for Somerset County, New	Jersey,	STREAMS
Jersey, W89-02592 2E	W89-02592 2E	Pesticide Impact on Stream Fauna with Special Reference to Macroinvertebrates,
	STREAM EROSION Blountstown Reach, Apalachicola River, Mova-	W89-02773 5C
Stormflow Characteristics of Three Small Lime- stone Drainage Basins in North Island, New	ble-Bed Model Study,	Summary of Maryland Stream pH and Alkalini-
Zealand, W89-02735 2A	W89-02416 2J	ty Data: Analysis of Its Application to Assessing
	Jefferson Barracks Bridge, Movable-Bed Model Study,	the Impacts of Acidic Deposition, W89-02840 5C
Quantity and Quality of Storm Runoff from Three Urban Catchments in Bellevue, Washing-	W89-02417 2J	Maryland Synoptic Stream Chemistry Survey:
ton, W89-03000 5B	Analysis of Bank Stability in the DEC Water- sheds, Mississippi,	Estimating the Number and Distribution of Streams Affected By or At Risk from Acidifica-
Runoff Characteristics and Washoff Loads from Rainfall-Simulation Experiments on a Street Sur-	W89-02825 4D	tion, W89-02846 5B
face and a Native Pasture in the Denver Metro-	Pattern of Wash Erosion Around an Upland Stream Head,	
politan Area, Colorado, W89-03036 2E	W89-02886 2J	Chemical and Biological Survey of Lakes and Streams Located in the Emerald Lake Water- shed, Sequoia National Park,
STORM SEEPAGE	Influence of Vegetation on Stream Channel Processes,	W89-02852 2H
Rapid Subsurface Flow and Streamflow Solute Losses in a Mixed Evergreen Forest, New Zea-	W89-02911 2J	Rapid Subsurface Flow and Streamflow Solute
land,	Stream Response to Flash Floods in Upland	Losses in a Mixed Evergreen Forest, New Zea-
W89-02890 2G	Scotland, W89-02912 2E	land, W89-02890 2G
STORMS Oklahoma-Kansas Mesoscale Convective	STREAM IMPROVEMENT	
System of 10-11 June 1985: Precipitation Struc- ture and Single-Doppler Radar Analysis,	Fish Populations of a Small Lowland Channel- ized River in England Subject to Long-Term	Ohio Stream Regionalization Project: A Com- pendium of Results, W89-02932 2H
W89-03273 2B	River Maintenance and Management Works, W89-03139 6G	
Relationship of Surface Pressure Features to the		Interpretation of 'Controlled' vs 'Natural' Ex- periments in Streams,
Precipitation and Airflow Structure of an In- tense Midlatitude Squall Line,	STREAM QUALITY Modification and Assessment of an Index of	W89-03117 7A
W89-03274 2B	Biotic Integrity to Quantify Stream Quality in Southern Ontario,	Probability Distribution for Critical DO Loca-
Diagnostic Technique for Targeting during Air- borne Seeding Experiments in Wintertime	W89-03211 4C	tion in Streams, W89-03292 7B
Storms over the Sierra Nevada,	STREAMFLOW	STRESS
W89-03305 2B	River Dynamics, Flow Regime and Sediment Transport,	Fertility and Disturbance Gradients: A Summa-
STRATIFICATION Mobile Bay Estuary: Stratification, Oxygen De-	W89-02432 2J	ry Model for Riverine Marsh Vegetation, W89-03294 2H
pletion, and Jubilees, W89-02696 2L	History of Annual Streamflows from the 21	
	and Puerto Rico, 1951-83,	STRINGFELLOW HAZARDOUS WASTE SITE Stringfellow Leachate Treatment with RBC,
Djinnang II: A Facility to Study Mixing in Stratified Waters,	107-02473	W89-03328 5D
W89-02701 7E	Discharge Ratings for Control Structures at McHenry Dam on the Fox River, Illinois,	STRIP MINES
Interrelationship Between In Vivo Fluorescence of Phytoplankton and Light Beam Transmission	W89-02494 7B	Hydrogeochemistry of the Upper Part of the Fort Union Group in the Gascoyne Lignite
with Reference to Fluorescence Yield, W89-03233 21	Computer-Program Documentation of an Inter- active-Accounting Model to Simulate Stream-	Strip-Mining Area, North Dakota, W89-03026 4C

STRUCTURAL BEHAVIOR	SULFATES	SURFACE-GROUNDWATER RELATIONS
Dynamic Reservoir Interaction with Monticello Dam.	Fate of COD in an Anaerobic System Treating High Sulphate Bearing Wastewater,	Field Study of Ephemeral Stream-Aquifer Inter- action,
W89-02848 8A	W89-02295 5D	W89-02349 2F
Influence of Ground Water on Soil-Structure Interaction,	Sulfate Resistance of Mortars Made Using Port- land Cement and Blends of Portland Cement and	Ephemeral Runoff and Groundwater Recharge, W89-02350 2F
W89-02850 2F	Pozzolan or Slag, W89-02714 8F	Groundwater in China,
SUBLETHAL EFFECTS	Anaerobic Treatment of Sulfate-Containing	W89-02371 2F
Long-Term Sublethal Acid Exposure in Rain-	Waste Water,	PakistanStatus Report,
bow Trout (Salmo gairdneri) in Soft Water: Effects on Ion Exchanges and Blood Chemistry,	W89-02930 5D	W89-02381 4B
W89-03226 5C		
1107-03220	SULFIDES	Development of Groundwater Resources in Sri
Chronic Effects of Cu on Reproduction of Poly- pedilum nubifer (Chironomidae) through Water	Combining Field Measurements for Speciation in Non Perturbable Water Samples: Application	Lanka, W89-02383 4B
and Food,	to the Iron and Sulfide Cycles in a Eutrophic	Hudadasia and Carlosia Data Sanda Educati
W89-03296 5C	Lake,	Hydrologic and Geologic Data for the Edwards Aquifer Recharge Zone Near Georgetown, Wil-
SUBMERGED PLANTS	W89-02645 5B	liamson County, Texas, 1986-87,
Data on the Distribution and Abundance of Sub-	SULFITE MILLS	W89-02499 2F
mersed Aquatic Vegetation in the Tidal Poto-	Syntrophic Bacteria Process to Convert a Pulp	
mac River and Estuary, Maryland, Virginia, and the District of Columbia, 1986,	Mill's Spent Sulphite Liquor to Hydrogen Sul- phide,	Determination of Evaporation and Seepage Losses, Upper Lake Mary near Flagstaff, Arizo-
W89-02511 7C	W89-03115 5D	na, W89-02558 2H
Banance of Cantal Blants to Increase in Sub-	SULFITES	
Response of Coastal Plants to Increase in Sub- mergence and Salinity,	Anaerobic Treatment of Sulfate-Containing	Effects of Fluctuating River-Pool Stages on
W89-03188 2L	Waste Water,	Groundwater Levels in the Adjacent Alluvial
11 07-03100	W89-02930 5D	Aquifer in the Lower Arkansas River, Arkansas,
Comparative Ecology of Submersed Grass Beds	CHILL THE IN	W89-02561 2F
in Freshwater, Estuarine, and Marine Environ-	SULFUR	Hydrologic Analysis of the Rio Grande Basin
ments,	Potential for Anaerobic Treatment of High Sulfur Wastewater in a Unique Upflow - Fixed	North of Embudo, New Mexico, Colorado and
W89-03264 2H	Film - Suspended Growth Reactor,	New Mexico,
SUBMERSED AQUATIC VEGETATION	W89-02290 5D	W89-02589 2F
Data on the Distribution and Abundance of Sub-		Hadesland of the Billite Tall Botto Acre March
mersed Aquatic Vegetation in the Tidal Poto-	SULFUR BACTERIA	Hydrology of the White Tail Butte Area, North- ern Campbell County, Wyoming,
mac River and Estuary, Maryland, Virginia, and	Investigation into Mechanisms of Microbial Ef-	W89-02596 4C
the District of Columbia, 1986,	fects on Iron and Manganese Transformations in Artificially Recharged Groundwater,	10702570
W89-02511 7C	W89-03078 4B	Effects of Irrigation Practices on Stream-Con-
SUBMERSED PLANTS		nected Phreatic Aquifer Systems,
Comparative Ecology of Submersed Grass Beds	SULFUR COMPOUNDS	W89-02661 3F
in Freshwater, Estuarine, and Marine Environ-	Anaerobic Biological Process for the Prevention	Stormflow Characteristics of Three Small Lime-
ments,	of Noxious Odors in Pulp Manufacturing,	stone Drainage Basins in North Island, New
W89-03264 2H	W89-02928 5D	Zealand,
SUBSIDENCE	SUPERFUND	W89-02735 2A
Records of Wells, Drillers' Logs, Water Level	Liability for Managing Hazardous Wastes: Past,	Land Subsidence in the Can Taxonin Valley
Measurements, and Chemical Analyses of	Present and Future,	Land Subsidence in the San Joaquin Valley, California, as of 1980,
Groundwater in Harris and Galveston Counties,	W89-02398 6E	W89-03018 6G
Texas 1980-84,	Superfund Record of Decision: Distler Farm,	
W89-02497 7C	KY.	Land Subsidence in the Santa Clara Valley, Cali-
Groundwater Withdrawals and Changes in	W89-02778 5G	fornia, as of 1982,
Groundwater Withdrawals and Changes in Groundwater Quality and Land Surface Subsid-		W89-03019 6G
ence in the Houston District, Texas,	Superfund Record of Decision: Northern En-	Movement and Survival of Bacteria in Porous
W89-02519 6G	graving, WI. W89-02938 5B	Media,
	W89-02938 5B	W89-03080 5B
Land Subsidence in the San Joaquin Valley,	Superfund Record of Decision: Kane and Lom-	CLIDITA CIVI DADOCTIDO
California, as of 1980,	bard, MD.	SURFACE PRESSURE
W89-03018 6G	W89-02977 5E	Relationship of Surface Pressure Features to the Precipitation and Airflow Structure of an In-
Land Subsidence in the Santa Clara Valley, Cali-	Superfund Record of Decision: Katonah Munici-	tense Midlatitude Squall Line,
fornia, as of 1982,	pal Well, NY.	W89-03274 2B
W89-03019 6G	W89-02979 5G	
SUCKER		SURFACE RUNOFF
Growth, Fecundity, and Energy Stores of White	Superfund Record of Decision: Independent	Synoptic-Scale Assessment of Surface Runoff,
Sucker (Catostomus commersoni) from Lakes	Nail, SC.	W89-02703 2E
Containing Elevated Levels of Copper and Zinc,	W89-02980 5G	SURFACE WATER
W89-03225 5C	Superfund Record of Decision: Endicott Well	Hydrogeological Mapping in Asia and the Pacif-
CHICATION I THE BECOME STORY	Field, NY.	ic Region.
SUCTION LIFT RECOVERY SYSTEMS	W89-02983 5G	W89-02364 7B
Advantages of Suction Lift Hydrocarbon Re- covery Systems: Application At Three Hydro-	Superfund Record of Decision: Vega Alta, PR.	Hydrogeological Development in Vanuatu,
geologic Environments in California.	W89-02984 Superfund Record of Decision: Vega Alta, PR.	W89-02368 2F
W89-02358 5G		
	SURFACE-GROUNDWATER CONJUNCTIVE	Water-Bearing Zones in the Mining Area of the
SUGARCANE	MANAGEMENT	Northern Region of Bangladesh with Regard to
Anaerobic Treatment of Molasse/Sugar Cane		Utilization of Mine Water for Irrigation and Other Uses,
Stillage with High Minerals, W89-02289 5D	Basin, W89-02482 4B	W89-02369 2F
11 07-02207 DD	11 07*U2402 4D	11 U7-U63U7 AF

SURFACE WATER

Development and Achievements of Hydrogeo- logical Mapping in China,	Macrofauna of Subtidal Sediments Using Remote Sampling,	Magnitude and Frequency Characteristics of Suspended Sediment Transport in Devon
W89-02370 2F	W89-02764 2L	Rivers, W89-02904 2J
Groundwater Resources Development and Man-	Processing Sediment Macrofauna Samples,	W 89-02904 23
agement in India,	W89-02765 7B	SUSPENDED SEDIMENTS
W89-02373 2F		Suspended Load in Gravel-Bed Rivers: UK Ex-
Notes on the Hydrogeological Map of Sarawak,	Meiofauna,	perience,
W89-02378 2F	W89-02766 2L	W89-02452 2J
Missan Barrers and Hardenson Indian Manager	Intertidal Rock,	Water Resources Investigations in Tennessee:
Water Resources and Hydrogeological Mapping in the Mongolian People's Republic,	W89-02767 2L	Programs and Activities of the U.S. Geological
W89-02379 2F	Cabridal Book and Challens Codiments Heine	Survey, 1987-1988,
	Subtidal Rock and Shallow Sediments Using Diving,	W89-02559 7C
PakistanStatus Report, W89-02381 4B	W89-02768 7B	Supported Sediment Properties and Their Cair
W89-02381 4B		Suspended Sediment Properties and Their Geo- morphological Significance,
Hydrology of Area 31, Eastern Region, Interior	Bacteria and Fungi,	W89-02899 2J
Coal Province, Illinois and Indiana,	W89-02769 7B	
W89-02508 5B	Plankton,	Monitoring Baseline Suspended Sediment in
Drainage Areas in the James River Basin in	W89-02770 2L	Forested Basins: The Effects of Sampling on
Eastern South Dakota,	T1.00	Suspended Sediment Rating Curves, W89-03053 2J
W89-02515 7C	Fish (Survey of),	W 65-03033
Water Resources Investigations in Tennessee:	W89-02771 7B	SUSPENDED SOLIDS
Programs and Activities of the U.S. Geological	Birds,	Development of Estimation Methods for Tribu-
Survey, 1987-1988,	W89-02772 2L	tary Loading Rates of Toxic Chemicals,
W89-02559 7C		W89-02547 5B
Water Resources Investigations in Tennessee:	National Surface Water Survey: National	Effects on Suspended and Substrate Sediments
Programs and Activities of the U.S. Geological	Stream Survey Phase I - Pilot Survey, W89-02842 5G	in Two Streams Resulting from Different Gas-
Survey, 1987-1988,	W 69-02642 3G	Pipeline Installation Techniques,
W89-02570 9C	Survey of Sensitivity of Southern California	W89-02823 4C
Water Resources Activities of the U. S. Geologi-	Lakes to Acid Deposition,	
cal Survey in Texas - Fiscal Year 1987,	W89-02864 5C	Surface and Subsurface Sources of Suspended Solids in Forested Drainage Basins in the
W89-02574 9C	Western Lake Survey, Phase I. Data Base.	Keuper Region of Luxembourg,
Water Orelity of Course Lake Control Toron	W89-02946 2H	W89-02892 2J
Water Quality of Canyon Lake, Central Texas, W89-02579 2H		
W 07-02319 211	Monitoring and Surveillance,	SWAMPS
Surface Water Quality Characteristics in the	W89-02991 7B	Hydrochory and Regeneration in a Bald Cy-
Upper North Fork Gunnison River Basin, Colo-	Nonparametric Evaluation of the Size of Limno-	press-Water Tupelo Swamp Forest, W89-03295 2H
rado, W89-02593 5B	logical Sampling Networks: Application to the	W 69-03293
110702373	Design of a Survey of Green Bay,	SWEDEN
Conjunctive Use of Surface and Ground Water	W89-03174 7A	Soil Acidification and Metal Solubility in For-
in the South Platte, River Basin: A Case Study	SUSPENDED LOAD	ests of Southern Sweden,
of the Central Colorado Water Conservancy District,	Sediment Transport in Gravel-Bed Rivers.	W89-02308 5E
W89-02659 6D	W89-02430 2J	Clogging Problems in Groundwater Heat Pump
		Systems in Sweden,
Surface Water Hydrology, W89-02719 2E	Influence of Large Suspended-Sediment Con-	W89-03089 2F
W89-02/19 2E	centrations in Rivers, W89-02451 2J	CHINA CINC DOOLS
Emerging Issues in Surface Water Quality Re-	W 89-02431	SWIMMING POOLS Problems of the Toyloglasical Competibility of
search,	Suspended Load in Gravel-Bed Rivers: UK Ex-	Problems of the Toxicological Compatibility o Hydrogen Peroxide in Drinking and Swimming
W89-02721 5G	perience,	Pool Water for Humans from the Pharmacokine
Processes, Coefficients, and Models for Simulat-	W89-02452 2J	tic and Biochemical Points of View (Probleme
ing Toxic Organics and Heavy Metals in Surface	Vertical Profiles of Velocity and Suspended	Der Humantoxikologischen Vertraglichkeit von
Waters,	Sediment in Streams near Mount St. Helens,	Wasserstoffperoxid in Bade- and Trinkwasse
W89-02788 5B	Washington,	aus Biochemischer und Pharmakokinetische Sicht),
SURFACE-WATER HYDROLOGY	W89-02523 2J	W89-03042 50
Hydrology in Practice,	Formulas for Velocity, Sediment Concentration	110700012
W89-02421 2A	and Suspended Sediment Flux for Steady Uni-	SYMPOSIUM
SURFACE WATERS	Directional Pressure-Driven Flow,	Proceedings of the FOCUS Conference of
National Surface Water Survey: National	W89-02779 2J	Southwestern Ground Water Issues. W89-02331 21
Stream Survey Phase I - Pilot Survey,	Suspended Sediment Bennesties and Their Con-	W89-02331
W89-02842 5G	Suspended Sediment Properties and Their Geo- morphological Significance,	SYNOPTIC ANALYSIS
SURVEYS	W89-02899 2J	Synoptic-Scale Assessment of Surface Runof
Biological Surveys of Estuaries and Coasts.		W89-02703 21
W89-02759 7B	SUSPENDED SEDIMENT	CVCTCM ANALYCIC
Planning Biological Surveys,	Water Quality Data (July 1986 Through Sep-	SYSTEM ANALYSIS Microcomputer Program Development for Or
W89-02760 7B	tember 1987) and Statistical Summaries (March 1985 Through September 1987) for the Clark	Farm Irrigation Systems Planning,
	Fork and Selected Tributaries from Deer Lodge	W89-02550 64
Remote Sensing,	to Missoula, Montana,	
W89-02761 7B	W89-02566 5B	SYSTEMS ANALYSIS
Salt Marshes,	Paraulas for Valority C. C	Role of Tracer Methods in Hydrology as
W89-02762 7B	Formulas for Velocity, Sediment Concentration and Suspended Sediment Flux for Steady Uni-	Source of Physical Information: Basic Concep and Definitions, Time Relationship in Dynami
Flora and Macrofauna of Intertidal Sediments,	Directional Pressure-Driven Flow,	Systems,
W89-02763 2L	W89-02779 2J	W89-03010 7

7B

Extended Period Simulation of Water Systems – Direct Solution, W89-03106 5F	TERRAIN ANALYSIS Assessment of Hydrogeological Features Using the Technique of Terrain Classification,	Trace Metal Transport in a Tropical Estuary, W89-03276 2L
TANNERY WASTES	W89-02372 7B	THALLIUM Determination of Traces of Thallium in Various
Supplemental Final Development Document for Effluent Limitations Guidelines, New Source	TEXAS Quantity and Quality of Recharge to the Ogal- lala Aquifer from Urban Runoff,	Matrices, W89-03067 5A
Performance Standards and 1. reatment Standards for the Leather Tanning and Finishing Point Source Category.	W89-02340 4C	THE NETHERLANDS Clean Technology in the Netherlands: The Role
W89-02832 6E	Groundwater Resources of Rusk County, Texas, W89-02491 2F	of the Government, W89-02801 5G
TASTE	Described Wells Delicat Law Water Law	
Pretreatment of Drinking Water to Control Or- ganic Contaminants and Taste and Odor, W89-02793 5F	Records of Wells, Drillers' Logs, Water Level Measurements, and Chemical Analyses of Groundwater in Harris and Galveston Counties,	THERMAL POLLUTION Nearshore Transport Processes Affecting the Dilution and Fate of Energy-Related Contami-
TECHNOLOGY	Texas 1980-84, W89-02497 7C	nants, W89-02972 5B
Clean Technology in the Netherlands: The Role	Hydrologic and Geologic Data for the Edwards	
of the Government, W89-02801 5G	Aquifer Recharge Zone Near Georgetown, Williamson County, Texas, 1986-87, W89-02499 2F	THERMAL STRESS Effect of Temperature on the Chronic Toxicity of Hydrothol-191 to the Fathead Minnow (Pi-
TECHNOLOGY TRANSFER	W89-02499 2F	mephales promelas), W89-03206 5C
Municipal Wastewater Treatment Technology Transfer Activities of the United States Environ-	Relation of Water Chemistry of the Edwards Aquifer to Hydrogeology and Land Use, San	THERMAL WATER
mental Protection Agency, W89-03325 5D	Antonio Region, Texas, W89-02514 5B	Aquifer Thermal Energy Storage in Finland, W89-03082 4B
TEMPERATURE	Effects of Runoff Controls on the Quantity and	THERMODYNAMICS
Pollution Control Using Room Temperature Evaporators, W89-02400 5G	Quality of Urban Runoff at Two Locations in Austin, Texas, W89-02518 5B	Concept of Electron Activity and its Relation to Redox Potentials in Aqueous Geochemical Sys- tems,
TEMPERATURE EFFECTS	Groundwater Withdrawals and Changes in	W89-02580 2K
Effect of Temperature on the Chronic Toxicity of Hydrothol-191 to the Fathead Minnow (Pimephales promelas),	Groundwater Quality and Land Surface Subsidence in the Houston District, Texas, W89-02519 6G	Thermodynamic Calculations with Special Ref- erence to the Aqueous Aluminum System, W89-02641 2K
W89-03206 5C	Water Resources Activities of the U. S. Geologi-	
Effects of Temperature, Salinity and Seagrass Species on the Uptake of Lead(II) from Sea-	cal Survey in Texas - Fiscal Year 1987, W89-02574 9C	THUNDERSTORMS Cumulus and Thunderstorm Initiation by Mountains,
water by Excised Leaves, W89-03275 5B	Water Quality of Canyon Lake, Central Texas, W89-02579 2H	W89-02787 2B
TENNESSEE		TIDAL BASINS Sediment Transport Prediction in a Tidal Inlet
Water Resources Publications of the U.S. Geological Survey, For Tennessee, 1906-1987,	Groundwater Resources of Limestone County, Texas, W89-02583 2F	Using a Numerical Model: Application to Stony Brook Harbor, Long Island, New York, USA,
W89-02467 10C		W89-03185 2J
Construction, Geologic, and Hydrologic Data for Observation Wells in the Reelfoot Lake	Hydrologic Data for Urban Studies in the Austin Metropolitan Area, Texas, 1986, W89-02597 4C	TIDAL CURRENTS Oceanography of Chesapeake Bay,
Area, Tennessee and Kentucky, W89-02510 7B	Land and Water Management Issues: Texas	W89-02693 2L
Water Quality of Runoff to the Clarksville Me-	High Plains, W89-02634 6D	Puget Sound: A Fjord System Homogenized with Water Recycled over Sills by Tidal Mixing,
morial Hospital Drainage Well and of Mobley		W89-02694 2L
Spring, Clarksville, Tennessee, February-March 1988,	Laguna Madre of Texas: Hydrography of a Hy- persaline Lagoon,	TIDAL ENERGY
W89-02556 5B	W89-02695 2L	Physical Energy Inputs and the Comparative Ecology of Lake and Marine Ecosystems,
Quality of Groundwater in Shallow Wells in Agricultural Areas of Haywood, Shelby, Lake,	Floods in Central Texas, August 1-4, 1978, W89-03025 2E	W89-03272 2A
and Obion Counties, Tennessee, January-Febru-	Summary of the High Plains Regional Aquifer-	TIDAL FLUSHING Flow Simulation Model of the Tidal Potomac
ary 1988, W89-02557 5B	System Analysis in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South	River, W89-02529 2L
Water Resources Investigations in Tennessee:	Dakota, Texas, and Wyoming,	TIDAL HYDRAULICS
Programs and Activities of the U.S. Geological Survey, 1987-1988,	W89-03030 2F	Tidally Generated Estuarine Mixing Processes,
W89-02559 7C	Effects of Future Ground-Water Pumpage on the High Plains Aquifer in Parts of Colorado,	W89-02686 2L
Water Resources Investigations in Tennessee: Programs and Activities of the U.S. Geological	Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming,	Tidal Dynamics of Estuaries, W89-02687 2L
Survey, 1987-1988,	W89-03031 2F	Modeling of Tidally Induced Residual Currents
W89-02570 9C	TEXTBOOKS Hydrology in Practice,	W89-02690 2L
Regionalization of Winter Low-flow Character- istics of Tennessee Streams,	W89-02421 2A	TIDAL MARSHES Salt Marshes,
W89-03005 2E	Principles of Farm Irrigation System Design,	W89-02762 7E
TENNESSEE RIVER	W89-02422 3F	Above- and Below-Ground Macrophyte Pro
North Alabama Water Quality Assessment,	THAILAND	duction in Scirpus Tidal Marshes of the St
Volume VIII - Water Quality Modeling, W89-02702 5B	Status of Hydrogeological Mapping in Thailand, W89-02384 2F	Lawrence Estuary, Quebec, W89-03055 21

2L

TIDES Oceanography of Chesapeake Bay,	TOXIC SUBSTANCES CONTROL ACT Liability for Managing Hazardous Wastes: Past,	Biochemical Testing of Groundwater, W89-03085 5A
W89-02693 2L	Present and Future,	T 13 COL . I DODA C
Oceanographic Characteristics of the Seine Es-	W89-02398 6E	Toxicity of Selected RCRA Compounds to Ac- tivated Sludge Microorganisms,
tuary,	TOXIC WASTES	W89-03165 5D
W89-02699 2L	Process Development and Treatment Plant	
TILE DRAINS Saline Seep on Wheatland in Northwest Oklaho-	Startup for an Explosives Industry Wastewater, W89-02287 5D	Fate and Eff=cts of Xanthates in Laboratory Freshwater Systems,
ma,	Anaerobic Digestion of Chemical Industry	W89-03201 5G
W89-02672 5B	Wastewaters Containing Toxic Compounds by	Acute Toxicity of Malathion, Tetrabromobis-
TIN	Downflow Fixed Film Technology.	phenol-A, and Tributyltin Chloride to Mysids
Acute Toxicity of Malathion, Tetrabromobis-	W89-02291 5D	(Mysidopsis bahia) of Three Ages,
phenol-A, and Tributyltin Chloride to Mysids	Fate of 4,6-Dinitro-o-Cresol in Municipal Acti-	W89-03203 5C
(Mysidopsis bahia) of Three Ages, W89-03203 5C	vated Sludge Systems,	Sensitivity of Branchial Mucus to Crude Oil
W89-03203 5C	W89-02296 5D	Toxicity in a Freshwater Fish, Colisa fasciatus,
Determination of Tin in Environmental Samples	Anoxic/Oxic Activated Sludge Treatment of	W89-03204 5C
by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrome-	Cyanogens and Ammonia in the Presence of	Effects of Water Soluble Crude Oil Fractions on
try,	Phenols,	Cirral Beat Frequency in Balanus balanoides,
W89-03303 5A	W89-02298 5D	W89-03205 5C
Portable Environment Test System: A Field As-	Partitioning of Toxic Organic Compounds on	Effect of Temperature on the Chronic Toxicity
sessment of Organotin Leachates. Test and Eval-	Municipal Wastewater Treatment Plant Solids, W89-02299 5D	of Hydrothol-191 to the Fathead Minnow (Pi- mephales promelas),
W89-03324 5C	Patapsco Wastewater Treatment Plant Toxicity	W89-03206 5C
TINAU RIVER	Reduction Evaluation,	Effect of Assam Crude on Photosynthesis and
Hydrogeology of the Butwal-Bhairahwa Area,	W89-02300 5D	Associated Electron Transport System in Ana-
Lumbini Zone, Nepal,	Missator Assessment of Assesship Bostonial	baena doliolum,
W89-02380 2F	Microtox Assessment of Anaerobic Bacterial Toxicity.	W89-03207 5C
TISSUE ANALYSIS	W89-02301 5D	Acute Toxicity of Binary Mixtures of Five Ca-
Distribution Pattern and Reduction of Polychlo-	to the Desiration of Tenters De	tions (Cu(2+), Cd(2+), Zn(2+), Mg(2+), and
rinated Biphenyls (PCB) in Bluefish Pomatomus	Assessment of the Degree of Treatment Re- quired for Toxic Wastewater Effluents,	K(+)) to the Freshwater Amphipod Gammarus
saltatrix (Linnaeus) Fillets through Adipose Tissue Removal,	W89-02303 5D	lacustris (Sars): Alternative Descriptive Models, W89-03212 5C
W89-03199 5B		W89-03212 5C
Data-institution of Timin Province and Samular	Superfund Record of Decision: Distler Farm, KY.	Effect of pH on Speciation and Toxicity of
Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and	W89-02778 5G	Aluminum to Rainbow Trout (Salmo gairdneri),
Inductively Coupled Plasma-Mass Spectrome-		W89-03213 5C
try,	Biological Treatment of Toxic Industrial Waste,	Copper Intoxication in Chinook Salmon (Oncor-
W89-03303 5A	W89-02919 5D	hynchus Tshawystscha) Induced by Natural
Pesticides in Fish Tissue and Water from Tuttle	TOXICITY	Springwater: Effects on Gill Na(+), K(+)-
Creek Lake, Kansas,	Patapsco Wastewater Treatment Plant Toxicity	ATPase, and Plasma Glucose, W89-03228 5C
W89-03317 5B	Reduction Evaluation, W89-02300 5D	
TOPOGRAPHY	11 07-02500	Physiological Disturbances in Fish Living in
Dynamic Control by Topography in Estuaries,	Microtox Assessment of Anaerobic Bacterial	Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents,
W89-02684 2L	Toxicity, W89-02301 5D	W89-03234 5C
Controls on Overland Flow Generation,	W 69-02301 3D	
W89-02882 2E	Assessment of the Degree of Treatment Re-	Effects of Cadmium Exposure on Feeding of
Surface Topography of the Lower Part of Co-	quired for Toxic Wastewater Effluents,	Freshwater Planktonic Crustaceans, W89-03288 5C
lumbia Glacier, Alaska, 1974-81,	W89-02303 5D	W 65-03286
W89-03021 2C	Transport, Bioaccumulation, and Toxicity of	Effects of Cadmium on Consumption, Assimila-
Bed Topography Inferred From Airborne	Metals and Metalloids in Microorganisms under	tion and Biochemical Parameters of Daphnia magna: Possible Implications for Reproduction,
Radio-Echo Sounding of Columbia Glacier,	Environmental Stress, W89-02652 5B	W89-03289 5C
Alaska, W89-03022 2C		
	Biological Treatment of Toxic Industrial Waste,	Impairment of Mobility and Development in
TOXAPHENE	W89-02919 5D	Freshwater Snails (Physa fontinalis and Lym- naea stagnalis) Caused By Herbicides,
Gas Chromatographic Residue Patterns of Toxa- phene in Fish Samples from the Great Lakes and	Toxicity of Heavy Metals to Thermophilic An-	W89-03290 5C
from Rivers of the Southeastern United States,	aerobic Digestion,	Change Effects of Cu on Bonneduction of Dela
W89-02328 5B	W89-02922 5D	Chronic Effects of Cu on Reproduction of Poly- pedilum nubifer (Chironomidae) through Water
TOXIC CHEMICAL DISCHARGES	Toxicity of DEGDN, Synthetic-HC Smoke	and Food,
Contribution of Toxic Chemicals to Groundwat-	Combustion Products, Solvent Yellow 33 and	W89-03296 5C
er for Domestic On-Site Sewage Disposal Sys-	Solvent Green 3 to Freshwater Aquatic Organisms,	Review of Environmental Toxicity of Quater-
tems, W89-02584 5B	W90 00036	nary Ammonium Halides,
		W89-03298 5C
TOXIC CHEMICALS	Problems of the Toxicological Compatibility of Hydrogen Peroxide in Drinking and Swimming	Results of a Short-Term Toxicity Study for
Development of Estimation Methods for Tribu- tary Loading Rates of Toxic Chemicals,	Pool Water for Humans from the Pharmacokine-	Three Organic Chemicals Found in Niagara
W89-02547 5B	tic and Biochemical Points of View (Probleme	River Drinking Water,
	Der Humantoxikologischen Vertraglichkeit von	W89-03310 5C
TOXIC METALS Biogeochemistry of Lead-210 and Polonium-210	Wasserstoffperoxid in Bade- and Trinkwasser aus Biochemischer und Pharmakokinetischer	Chronic Effects of Contaminated Sediment on
in Fresh Waters and Sediments,	Sicht),	Daphnia magna and Chironomus tentans,
W89-02555 2K	W89-03042 5C	W89-03312 5C

5C

Acute Toxicity and Behavioral Effects of Acry- lates and Methacrylates to Juvenile Fathead	Combining Field Measurements for Speciation in Non Perturbable Water Samples: Application	Role of Tracer Data for Modeling Soil-Water Flow in the Unsaturated Zone,
Minnows, W89-03313 5C	to the Iron and Sulfide Cycles in a Eutrophic Lake,	W89-03013 2G
Toxicity of Six Heterocyclic Nitrogen Com-	W89-02645 5B	Solute Transport in Fractured Rocks, W89-03014 2F
pounds to Daphnia pulex, W89-03315 5C	Comparison of Anodic Stripping Voltammetry Speciation Data with Empirical Model Predic-	Computer Modelling of Confined Aquifer Sys-
Evaluation of the Acute Toxicity to Juvenile	tions of pCu, W89-02646 7B	tems for Interpretation of Chemical and Envi- ronmental Isotope Data,
Pacific Salmonids of Hexazinone and its Formu- lated Products: Pronone 10G, Velpar L, and	Chromatographic Approaches to Trace Element	W89-03015 2F
Their Carriers, W89-03316 5C	Speciation, W89-02648 5A	Application of a Transport-Diffusion Model to a Coastal Aquifer Utilizing In situ Measurements
TRACE ELEMENTS Water Quality Data (July 1986 Through Sep-	Partitioning of Trace Metals in Sediments, W89-02649 5B	of Dispersivity, W89-03016 2F
tember 1987) and Statistical Summaries (March 1985 Through September 1987) for the Clark Fork and Selected Tributaries from Deer Lodge	Metal Speciation and Interactions among Ele- ments Affect Trace Element Transfer in Agri-	Use of Linear Compartmental Simulation Ap- proach for Quantitative Interpretation of Isotope Data under Time Variant Flow Conditions.
to Missoula, Montana, W89-02566 5B	cultural and Environmental Food-Chains, W89-02650 5B	W89-03017 7C
Chromatographic Approaches to Trace Element	Trace Metal Speciation in Sediments and Soils:	Sediment Transport from Delaware Bay to the
Speciation, W89-02648 5A	An Overview from a Water Industry Perspec- tive,	New Jersey Inner Shelf, W89-03187 2J
Metal Speciation and Interactions among Ele-	W89-02651 5B	Pu(239,240) Residence Times in Freshwaters
ments Affect Trace Element Transfer in Agri- cultural and Environmental Food-Chains,	Metal Treatment and Recovery, W89-02653 5D	and Accumulation in Shield Lake Sediments, W89-03209 2H
W89-02650 5B		TRAINING
Acid Precipitation Literature Review 1986: Emission, Transport, Transformation and Depo-	Determination of Traces of Thallium in Various Matrices,	Fiscal Year 1986 Program Report (Colorado Water Resources Research Institute),
sition of Acidic Trace Species, W89-02822 5B	W89-03067 5A	W89-02477 9D
Determination of Metals with ICP-AES in Com-	Sediment Transport from Delaware Bay to the New Jersey Inner Shelf,	Fiscal Year 1986 Program Report (Wyoming Water Research Center),
parison to the AAS, Photometry, and Millival-	W89-03187 2J	W89-02479 9D
Balance of the Anions (Die Metallbestimmung mit der ICP-AES im Vergleich zur AAS, Pho-	Trace Metal Transport in a Tropical Estuary, W89-03276 2L	Fiscal Year 1987 Report (Georgia Water Re-
tometrie und Anionen-Millival-Bilanz), W89-03048 5A	TRACER STUDIES	sources Research Institute), W89-02553 9D
Factors Controlling the Biogeochemical Cycles of Trace Elements in Fresh and Coastal Marine	Pre-Feasibility on Streamflow Gauging Using Radioisotope Tracer Method for Kemumbu Ag- riculture Development Authority (KADA),	Fiscal Year 1987 Program Report (North Carolina Water Resources Research Institute).
Waters as Revealed by Artificial Radioisotopes, W89-03263 2H	W89-02713 2E	W89-02554 9D
TRACE LEVELS	TRACERS	TRANSPARENCY
Extraction, Clean-up and Group Separation Techniques in Organochlorine Trace Analysis, W89-03068 5A	Measurement of Groundwater Velocity with a Colorimetric Borehole Dilution Instrument, W89-02345 7B	Relationships Among Secchi Disk Depth, Beam Attenuation Coefficient, and Irradiance Attenuation Coefficient for Great Lakes Waters,
Ultra-Trace-Level Determination of Cobalt,	Stable Isotopes: An Investigation into Their Ap-	W89-03176 2H
Chromium, and Hydrogen Peroxide by Luminol Chemiluminescence Detected With a Charge-	plication in Karst Hydrology in the U.K., with Special Reference to the Malham Area, North Yorkshire,	TRAVIS COUNTY Effects of Runoff Controls on the Quantity and Quality of Urban Runoff at Two Locations in
Coupled Device, W89-03181 7B	W89-02734 2F	Austin, Texas, W89-02518 5B
Results of a Short-Term Toxicity Study for	Isotopic Investigation on the Evolution of Groundwater Dynamics in the Principal	TREES
Three Organic Chemicals Found in Niagara River Drinking Water, W89-03310 5C	Aquifers in the Southern Dobrudja, W89-02853 2F	Responses of Four Irish Wetland Tree Species to Raised Soil Water Levels,
TRACE METALS	Development of Field Techniques for Assess-	W89-03128 2H
Comparison of Lake Sediments and Ombrotro- phic Peat Deposits as Long-Term Monitors of	ment of River Erosion and Deposition in Mid- Wales, UK,	TRICHLOROETHANE Pilot Plant Demonstration of In-situ Biodegrada-
Atmospheric Pollution, W89-02321 5A	W89-02898 2J	tion of 1,1,1-Trichloroethane, W89-03164 5D
Water Quality of Runoff to the Clarksville Me-	Mathematical Models for Interpretation of Tracer Data in Groundwater Hydrology.	TRICKLING FILTERS
morial Hospital Drainage Well and of Mobley Spring, Clarksville, Tennessee, February-March	W89-03009 2F	Unit Process Tradeoffs for Combined Trickling Filter and Activated Sludge Processes,
1988, W89-02556 5B	Role of Tracer Methods in Hydrology as a Source of Physical Information: Basic Concepts and Definitions, Time Relationship in Dynamic	W89-03160 5D
Metal Speciation: Theory, Analysis and Applica-	Systems, W89-03010 7B	TRICLORFON In Vivo and In Vitro Effect of Triclorfon on
tion. W89-02640 5B	General Review of Methodologies and Ap-	Esterases of the Red Crayfish Procambarus clar- kii,
Coordination Chemistry at the Solid/Solution	proaches in Mathematical Models for Interpreta-	W89-03314 5C
Interface, W89-02642 5B	tion of Tracer Data in Hydrology, W89-03011 2F	TRITIUM
Reactions and Transport of Trace Metals in	Review of Existing Mathematical Models for	Use of Linear Compartmental Simulation Ap- proach for Quantitative Interpretation of Isotope
Groundwater, W89-02644 5B	Interpretation of Tracer Data in Hydrology, W89-03012 2F	Data under Time Variant Flow Conditions, W89-03017 7C

TROPHIC LEVEL

TROPHIC LEVEL	Effect of Long-Term Exposure to Acid, Alumi-	UNDERGROUND STRUCTURES
Water Quality Assessment of Arvada Reservoir,	num, and Low Calcium on Adult Brook Trout	Geomembrane Liner Reduces Leakage in Un-
Denver Metropolitan Area, Colorado, W89-02562 2H	(Salvelinus fontinalis): I. Survival, Growth, Fe- cundity, and Progeny Survival,	derground Reservoir, W89-03281 5F
	W89-03241 5C	W 67-03261
Secondary Production and Trophic Relation-		UNDERWATER
ships in a Spring Invertebrate Community, W89-03250 2H	Effect of Long-Term Exposure to Acid, Alumi-	Subtidal Rock and Shallow Sediments Using
W89-03250 2H	num, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Os-	Diving,
TROPICAL FISHERIES	moregulation,	W89-02768 7B
Accounting for Effort When Comparing Tropi-	W89-03242 5C	UNIT HYDROGRAPHS
cal Fisheries in Lakes, River-Floodplains, and		Simulation of Flood Hydrographs for Georgia
Lagoons, W89-03269 2H	Morphometric Changes in Gill Secondary La-	Streams,
W 69-03209	mellae of Brook Trout (Salvelinus fontinalis) after Long-Term Exposure to Acid and Alumi-	W89-03002 5E
TROPICAL REGIONS	num.	UNITED KINGDOM
Circulation Anomalies in Tropical Australian	W89-03243 5C	Suspended Load in Gravel-Bed Rivers: UK Ex-
Estuaries, W89-02697 2L	THE PARTY OF THE P	perience,
	TRUCKEE RIVER Documentation for a Digital Computer Model	W89-02452 2J
Hydrological Development of Tropical Tower	of Nutrient and Dissolved-Oxygen Transport in	
Karst: An Example from Peninsular Malaysia,	the Truckee River and Truckee Canal Down-	UNITED STATES
W89-02739 2F	stream from Reno, Nevada,	History of Annual Streamflows from the 21
Floodplain Response of a Small Tropical	W89-02504 5B	Water Resources Regions in the United States and Puerto Rico, 1951-83,
Stream,	TSIRKU RIVER	W89-02493 7C
W89-02885 2E	Hydrologic Reconnaissance of the Chilkat River	110702170
Tropical and Monsoonal Studies,	Basin, Southeast Alaska (with Special Reference	U.S. Geological Survey Urban-Stormwater Data
W89-02968 2B	to the Bald Eagle Critical Habitat at the Tsirku	Base of Constituent Storm Loads; Characteris-
	River Alluvial Fan),	tics of Rainfall, Runoff, and Antecedent Condi- tions; and Basin Characteristics,
Accounting for Effort When Comparing Tropi- cal Fisheries in Lakes, River-Floodplains, and	W89-02565 2E	W89-02581 7C
Lagoons,	TUCSON	1107-02501
W89-03269 2H	Toward Sustaining a Desert Metropolis: Water	UNSATURATED FLOW
	and Land Use in Tucson, Arizona,	Role of Tracer Data for Modeling Soil-Water
Trace Metal Transport in a Tropical Estuary, W89-03276 2L	W89-02637 6D	Flow in the Unsaturated Zone,
W 65-03276 2L	TUNNELS	W89-03013 2G
TROUT	I-664 Bridge-Tunnel Study, Virginia Sedimenta-	UNSTABLE CHANNELS
Interstitial Water Quality of Lake Trout Spawn-	tion and Circulation Investigation,	Sediment Supply to Upland Streams: Influence
ing Habitat, W89-03172 5C	W89-02875 4C	on Channel Adjustment,
W 69-03172	WIRDINGS	W89-02435 2J
Effect of pH on Speciation and Toxicity of	TURBIDITY Nonparametric Evaluation of the Size of Limno-	UPGRADING
Aluminum to Rainbow Trout (Salmo gairdneri),	logical Sampling Networks: Application to the	Upgrading Hydro Turbines: An Operating
W89-03213 5C	Design of a Survey of Green Bay,	Authority's Experience,
Accumulation of Cadmium by Rainbow Trout,	W89-03174 7A	W89-03152 8C
Salmo Gairdneri, During Extended Exposure,	Manusina Water Clarity with a Black Disk	N I -b-i Sit Bl th- Oldert Blant
W89-03220 5B	Measuring Water Clarity with a Black Disk, W89-03251 7B	New Lebring Scheme Replaces the Oldest Plant on the Mur,
Long-Term Sublethal Acid Exposure in Rain-	W 65-03251	W89-03153 8C
bow Trout (Salmo gairdneri) in Soft Water:	TURBIDITY CURRENTS	
Effects on Ion Exchanges and Blood Chemistry,	Change in Sedimentation Following River Di-	Uprating of Four Indian Hydro Plants,
W89-03226 5C	version in the Eastmain Estuary (James Bay), Canada.	W89-03157 8C
Effects of Aluminum and Low pH on Net Ion	W89-03186 2J	URANIUM
Fluxes and Ion Balance in the Brook Trout		Hydrogeologic and Geochemical Aspects of
(Salvelinus fontinalis),	TURBINES	Contaminant Transport at the Falls City, Texas
W89-03235 5C	Developments in the Design of Bulb Turbines,	UMTRA Site,
Blood Gases, Acid-Base Status, Ions, and Hema-	W89-03069 8C	W89-02362 5B
tology in Adult Brook Trout (Salvelinus fontina-	Calculation of Prototype Cavitation Characteris-	Gastrointestinal Absorption of Soluble Uranium
lis) Under Acid/Aluminum Exposure,	tics in Large Bulb Turbines,	from Drinking Water,
W89-03236 5C	W89-03070 8C	W89-02957 5B
Physiological Evidence of Acclimation to Acid/	Uprating the Laufenburg Swiss/German Power	
Aluminum Stress in Adult Brook Trout (Salve-	Station with Ten Straflo Units,	Migration of Acidic Groundwater Seepage from Uranium-Tailings Impoundments: 1. Field Study
linus fontinalis): I. Blood Composition and Net	W89-03071 8C	and Conceptual Hydrogeochemical Model,
Sodium Fluxes,	Upgrading Hydro Turbines: An Operating	W89-03037 5B
W89-03237 5C	Authority's Experience,	
Physiological Evidence of Acclimation to Acid/	W89-03152 8C	Migration of Acidic Groundwater Seepage from
Aluminum Stress in Adult Brook Trout (Salve-	TURBUT PATE OF OW	Uranium-Tailings Impoundments: 2. Geochemi- cal Behavior of Radionuclides in Groundwater,
linus fontinalis): II. Blood Parameters by Cannu-	TURBULENT FLOW Experimental Study of Flow in Settling Tanks,	W89-03038 5B
lation, W89-03238 5C	W89-03107 8B	
		Migration of Acidic Groundwater Seepage from
Sodium Transport in the Brook Trout, Salve-	U.S. GEOLOGICAL SURVEY	Uranium-Tailings Impoundments: 3. Simulations of the Conceptual Model with Application to
linus fontinalis: Effects of Prolonged Low pH Exposure in the Presence and Absence of Alu-	Bibliography of U.S. Geological Survey Reports on the Water Resources of Florida, 1886-1984,	Seepage Area A,
minum,	W89-02527 10C	W89-03039 5B
W89-03239 5C		
	U.S. VIRGIN ISLANDS	URANIUM MINING

Fiscal Year 1986 Program Report (Virgin Islands Water Resources Research Center), W89-02588 9D

Simulating Underground Mines in a Regional Model,

4C

W89-02339

Effects of Low pH and Aluminum on Ventilation in the Brook Trout (Salvelinus fontinalis), W89-03240 5C

URBAN AREAS U.S. Geological Survey Urban-Stormwater Data	Hydrologic Data for Urban Studies in the Austin Metropolitan Area, Texas, 1986,	(Ambloplites rupestris) and Pumpkinseeds (Le- pomis gibbosus) in Lake St. Clair,
Base of Constituent Storm Loads; Characteris- tics of Rainfall, Runoff, and Antecedent Condi-	W89-02597 4C	W89-03171 2H
tions; and Basin Characteristics, W89-02581 7C	Assimilative Capabilities of Retention Ponds, W89-02856 5D	Hydrologic and Riparian Influences on the Import and Storage of Coarse Particulate Or- ganic Matter in a Prairie Stream,
Flood Loss Reduction by Metropolitan Regional Authorities in the United States,	Quantity and Quality of Storm Runoff from Three Urban Catchments in Bellevue, Washing-	W89-03214 2H
W89-02752 6E	ton, W89-03000 5B	VEGETATION ESTABLISHMENT Role of the Seed Bank in the Development of
URBAN HYDROLOGY	Runoff Characteristics and Washoff Loads from	Vegetation on a Freshwater Marsh Created
Quantity and Quality of Recharge to the Ogal- lala Aquifer from Urban Runoff,	Rainfall-Simulation Experiments on a Street Sur- face and a Native Pasture in the Denver Metro-	from Dredge Spoil, W89-03169 2H
W89-02340 4C	politan Area, Colorado, W89-03036 2E	VELOCITY
Estimating Magnitude and Frequency of Floods for Wisconsin Urban Streams,	URBAN WATERSHEDS	Vertical Profiles of Velocity and Suspended Sediment in Streams near Mount St. Helens,
W89-03003 2E	Quantity and Quality of Recharge to the Ogal- lala Aquifer from Urban Runoff,	Washington, W89-02523 2J
Runoff Characteristics and Washoff Loads from Rainfall-Simulation Experiments on a Street Sur-	W89-02340 4C	VERMONT
face and a Native Pasture in the Denver Metro- politan Area, Colorado,	URBANIZATION Estuaries: Concern Over Troubled Waters,	Analysis of Agricultural Nonpoint Pollution Control Options in the St. Albans Bay Water-
W89-03036 2E	W89-03279 7A	shed, W89-02419 5G
URBAN PLANNING	UTAH	
Urban Flood Problems: Their Scale and the Policy Response, W89-02746 4A	Seepage Study of A 15.3 Mile Section of the Central Utah Canal, Pahvant Valley, Millard County, Utah,	VERTICAL DISTRIBUTION Vertical Profiles of Velocity and Suspended Sediment in Streams near Mount St. Helens,
Conflicting Objectives in Floodplain Manage-	W89-02469 2E	Washington, W89-02523 2J
ment: Flood Damage Reduction Versus Heritage Preservation,	Elected Hydrologic Data for Pahvant Valley and Adjacent Areas, Millard County, Utah,	VIBRATIONS
W89-02749 6F	1987, W89-02569 7C	Vibration and Leakage of Weir Gates, W89-03073 8C
Design Standards for Building in Flood Hazard Areas: A Critical Look at US Experience and	Reconnaissance of the Hydrothermal Resources	VIBRIO
Possible Applications Abroad, W89-02751 4A	of Utah, W89-03020 2F	Temporal Relationship of Vibrio parahaemolyti- cus in Patients and the Environment, W89-03064 5B
URBAN RUNOFF	UTILITIES Upgrading Hydro Turbines: An Operating	VIETNAM
Dry Wells - Solution or Pollution: An Arizona Status Report,	Authority's Experience, W89-03152 8C	Hydrogeological Mapping in the Socialist Re- public of Vietnam.
W89-02338 5B	VADOSE ZONE	W89-02385 4B
Quantity and Quality of Recharge to the Ogal- lala Aquifer from Urban Runoff,	Modeling of Polychlorinated Biphenyls in	VIRGINIA
W89-02340 4C	Vadose Zone, W89-02353 5B	I-664 Bridge-Tunnel Study, Virginia Sedimenta- tion and Circulation Investigation, W89-02875 40
Comparison of Conceptually Based and Regres- sion Rainfall-Runoff Models, Denver Metropoli-	VALUE ENGINEERING Value Engineering for Small Communities.	
tan Area, Colorado, and Potential Applications in Urban Areas.	W89-02865 6B	VIRUSES Pretreatment for Wastewater Reclamation and
W89-02483 4C	VALVES	Reuse, W89-02820 5D
Sediment Discharge Data for the Lower Reach	Valves in Reservoir Outlets, W89-03072 8C	VOLATILE ORGANIC COMPOUNDS
of Campbell Creek, Anchorage, Alaska: May to September 1987,	VANUATU	Selection Guide for Volatilization Technologies for Water Treatment,
W89-02496 2J	Hydrogeological Development in Vanuatu, W89-02368 2F	W89-02863 5F
Effects of Runoff Controls on the Quantity and Quality of Urban Runoff at Two Locations in	VEGETABLE CROPS	Control of Volatile Organic Contaminants in
Austin, Texas, W89-02518 5B	Wastewater Irrigation of Vegetable Crops, W89-03282 5E	Groundwater by In-Well Aeration, W89-02955 5F
Data-Collection Methods and Data Summary	VEGETATION	Economic Evaluation of Air Stripping to
for the Assessment of Water Quality in Cedar	Vegetation and Climates of the Last 45,000 Years in the Vicinity of the Nevada Test Site,	Remove Volatile Organic Compounds from Water,
Creek, West-Central Illinois, W89-02520 7B	South-Central Nevada, W89-03024 7C	W89-02976 51
Water Quality of Runoff to the Clarksville Me-		VOLATILE ORGANICS Contribution of Toxic Chemicals to Groundwat
morial Hospital Drainage Well and of Mobley Spring, Clarksville, Tennessee, February-March	Fertility and Disturbance Gradients: A Summary Model for Riverine Marsh Vegetation,	er for Domestic On-Site Sewage Disposal Systems,
1988, W89-02556 5B	W89-03294 2H	W89-02584 51
U.S. Geological Survey Urban-Stormwater Data	VEGETATION EFFECTS Consequences of Cloud Water Deposition on	VOLATILIZATION Selection Guide for Volatilization Technologie
Base of Constituent Storm Loads; Characteris- tics of Rainfall, Runoff, and Antecedent Condi-	Vegetation at High Elevation, W89-02305 5B	for Water Treatment, W89-02863
tions; and Basin Characteristics, W89-02581 7C	Influence of Vegetation on Stream Channel	VOLCANOES
	Processes, W89-02911 2J	Vertical Profiles of Velocity and Suspende
Rainfall-Runoff Data for Somerset County, New Jersey,	Effect of Submersed Aquatic Macrophytes on	Sediment in Streams near Mount St. Helen Washington,
W89-02592 2E	Resource Partitioning in Yearling Rock Bass	W89-02523

Development Control Procedures in England	of Minimization of Mercury-Bearing Wastes at a	Respiration-Based Evaluation of Nitrification In-
and Wales, W89-02748 6F	Mercury Cell Chloralkali Plant, W89-02821 5E	hibition Using Enriched Nitrosomonas Cultures, W89-02302 7B
Pipeflow and Pipe Erosion in the Maesnant Ex-	Use and Disposal of Municipal Wastewater	New Porous Polymer for Off-Line Preconcen-
perimental Catchment, W89-02884 2E	Sludge. W89-02834 5E	tration of Chlorophenols from Water, W89-03286 5A
Development of Field Techniques for Assess- ment of River Erosion and Deposition in Mid-	Evaluation of Municipal Solid Waste Landfill Cover Designs,	Sewage Hardness and Mortality from Cancer and Cardiovascular Disease,
Wales, UK, W89-02898 2J	W89-02871 5E	W89-03309 5D
	Factors in Assessing the Compatibility of FMLs	WASTEWATER DISPOSAL
WALLEYE Biology of the Walleye in Lake Sharpe, South Dakota, 1964-1975,	and Waste Liquids, W89-02952 5E	Dry Wells - Solution or Pollution: An Arizona Status Report,
W89-02427 2H	U.S. Production of Manufactured Gases: Assess-	W89-02338 5B
WARNING SYSTEMS	ment of Past Disposal Practices, W89-02964 5E	Effects of Organic Wastes from Processing of
Flood Warning Dissemination: The British Ex- perience,		Green River Formation Oil Shale on Water Quality,
W89-02753 6F	Installation Restoration Program Phase II - Con- firmation/Quantification. Stage I.	W89-02487 5B
Warning Dissemination and Response with Short Lead Times,	W89-02999 5B	Use and Disposal of Municipal Wastewater Sludge.
W89-02754 6F	Promising Technologies for the Biological De- toxification of Hazardous Waste,	W89-02834 5E
WASHINGTON	W89-03322 5D	Pilot Scale Evaluation of Sludge Landfilling:
Hydrologic Data for Computation of Sediment Discharge, Toutle and North Fork Toutle	WASTE DUMPS	Four Years of Operation,
Rivers near Mount St. Helens, Washington,	Superfund Record of Decision: Kane and Lom-	W89-02978 5E
1980-84.	bard, MD.	Ocean Outfall System for Dense and Buoyant
W89-02571 7C	W89-02977 5E	Effluents, W89-03108 5E
Selected Groundwater Information for the Co-	WASTE MANAGEMENT	W 67-03106 JE
lumbia Plateau Regional Aquifer System, Wash- ington and Oregon, 1982-1985: Volume I, Geo-	Monitoring, Research, and Management: Inte- gration for Decisionmaking in Coastal Marine	Wastewater Irrigation of Vegetable Crops, W89-03282 5E
hydrology, W89-02572 7C	Environments, W89-02323 5A	WASTEWATER FACILITIES
	W 69-02323	Chemically Supported Oil and Grease Removal
Selected Groundwater Information for the Co- lumbia Plateau Regional Aquifer System, Wash- ington and Oregon, 1982-1985: Volume II,	How Clean Is Clean. (What Constitutes the Clean Closure of a Hazardous Waste Land Man- agement Facility),	in Municipal Wastewater Treatment Plants, W89-02813 5D
Water Levels, W89-02573 7C	W89-02399 5E	Pretreatment of Sludge Liquors in Sewage Treatment Plants,
Temperature Analysis, Howard A. Hanson Res-	Waste Minimization Audit Report: Case Studies	W89-02817 5D
ervoir, Washington: Mathematical Model Investigation,	of Minimization of Mercury-Bearing Wastes at a Mercury Cell Chloralkali Plant,	Treatment of Filter Effluents from Dewatering of Sludges by a New High Performance Floccu-
W89-02877 2H	W89-02821 5E	lation Reactor,
Quantity and Quality of Storm Runoff from Three Urban Catchments in Bellevue, Washing-	Corrective Measures for Releases to Ground- water from Solid Waste Management Units,	W89-02819 5D
ton,	W89-02844 5G	WASTEWATER IRRIGATION
W89-03000 5B	WASTE RECOVERY	Wastewater Irrigation of Vegetable Crops, W89-03282 5E
Methane Cycling in the Sediments of Lake	Pilot Scale Results of Metal Value Recovery	WASTEWATER OUTFALL
Washington, W89-03249 2H	from Mixed Metal Hydroxide Sludges, W89-02394 5D	Ocean Outfall System for Dense and Buoyan
WASTE-ASSIMILATIVE CAPACITY	Plating Waste Sludge Metal Recovery,	Effluents, W89-03108 5E
Development of Estimation Methods for Tribu- tary Loading Rates of Toxic Chemicals,	W89-02395 5D	Tunnel and Reservoir Plan Solution to Chica
W89-02547 5B	Electrolytic Recovery Theory, Application, Ad-	go's Combined Sewer Overflow, Basemen
WASTE DISPOSAL	vantages, W89-02407 5D	Flooding, and Pollution, W89-03134 4A
Combined Fixed Biological Film Media and Evaporative Cooling Media to Solidify Hazard-		
ous Wastes for Encapsulation and Efficient Dis-	Successful In House Recovery of Solvent, W89-02410 5G	WASTEWATER POLLUTION Tunnel and Reservoir Plan Solution to Chica
posal, W89-02294 5D	WASTE STORAGE	go's Combined Sewer Overflow, Basemen
8th AESF/EPA Conference on Pollution Con-	Factors in Assessing the Compatibility of FMLs	Flooding, and Pollution, W89-03134 44
trol for the Metal Finishing Industry. W89-02392 5G	and Waste Liquids, W89-02952 5E	
	WASTE TREATMENT	REUSE Pretreatment for Wastewater Reclamation an
Hazardous Waste Research Pertaining to Metal Finishing.	Treatment of Oil and Oily Wastes,	Reuse,
W89-02393 5G	W89-02963 5G	W89-02820 51
How Clean Is Clean. (What Constitutes the	WASTEWATER	WASTEWATER TREATMENT
Clean Closure of a Hazardous Waste Land Man-	Economic And Environmental Impacts of Using Municipal Sewage Effluent for Agricultura	
agement Facility), W89-02399 5E	Production,	W89-02287 Startup for an Explosives Industry Wastewate
	W89-02663 5E	
Superfund Record of Decision: Distler Farm, KY.	Wastewater Irrigation of Vegetable Crops,	Utilization of Nitrite Oxidation Inhibition to In prove the Nitrogen Elimination Process,
W89-02778 5G	W89-03282 51	

Anaerobic Treatment of Molasse/Sugar Cane Stillage with High Minerals, W89-02289 5D	Performance of Analytical Test Kits on Metal Finishing Wastewater Samples, W89-02403 5D	Hydrogen Sulphide Control in Municipal Sewers, W89-02810 5D
D		
Potential for Anaerobic Treatment of High Sulfur Wastewater in a Unique Upflow - Fixed Film - Suspended Growth Reactor,	Application of Statistical Process Control to Wastewater Pretreatment, W89-02404 5D	Coagulation as the First Step in Wastewater Treatment, W89-02811 5D
W89-02290 5D		
Anaerobic Digestion of Chemical Industry Wastewaters Containing Toxic Compounds by	Waste Water Reduction in Metal Fabrications Operations, W89-02405 5D	Pre-Precipitation for Improvement of Nitrogen Removal in Biological Wastewater Treatment, W89-02812 5D
Downflow Fixed Film Technology. W89-02291 5D	Wastewater Treatment: Optimizing an Existing	W89-02812 5D Chemically Supported Oil and Grease Removal
Treatment of Process Wastewater from Petro- chemical Plant Using a Rotating Biological Con-	System, W89-02406 5D	in Municipal Wastewater Treatment Plants, W89-02813 5D
tactor - A Case Study,	Electrolytic Recovery Theory, Application, Ad-	Chemical-Biological Treatment versus Chemical
W89-02292 5D	vantages, W89-02407 5D	Treatment: A Case Study,
Land Treatment of Nitroguanidine Wastewater,		W89-02814 5D
W89-02293 5D	Waste Treatment and Recycling of Mixed Wastewater from a Metal Finishing Company, W89-02408 5D	Influence of Sludge from Chemical Biological Wastewater Treatment on Nitrification and Di-
Combined Fixed Biological Film Media and Evaporative Cooling Media to Solidify Hazard-	W89-02408 5D	gestion,
ous Wastes for Encapsulation and Efficient Dis-	Successful In House Recovery of Solvent, W89-02410 5G	W89-02816 5D
posal, W89-02294 5D		Pretreatment of Sludge Liquors in Sewage
	Calpurnia and the Strip Barn, W89-02411 5D	Treatment Plants, W89-02817 5D
Fate of COD in an Anaerobic System Treating High Sulphate Bearing Wastewater,		
W89-02295 5D	Wastewater Characterization and Hazardous Waste Survey, Castle AFB, CA,	Heavy Metal Removal from Sewage Sludge: Practical Experiences with Acid Treatment.
Fate of 4,6-Dinitro-o-Cresol in Municipal Acti-	W89-02704 5D	W89-02818 5D
vated Sludge Systems,	Contribution to Computation of Sedimentation	Treatment of Filter Effluents from Dewatering
W89-02296 5D Pilot-Scale Anaerobic Biomass Acclimation	of Solids in Horizontal-Sedimentation basins (Ein Beitrag zur Berechnung der Sedimentation	of Sludges by a New High Performance Floccu- lation Reactor,
Studies with a Coal Liquefaction Wastewater,	von Feststoffen in Horizontal Durchstromten	W89-02819 5D
W89-02297 5D	Sandfangen), W89-02711 5D	Pretreatment for Wastewater Reclamation and
Anoxic/Oxic Activated Sludge Treatment of	Wastewater Treatment: Ozonation Processes	Reuse, W89-02820 5D
Cyanogens and Ammonia in the Presence of Phenols.	and Equipment. Citations from the Selected	
W89-02298 5D	Water Resources Abstracts Database (Jan 77 -	Economic Evaluation of Carbon Adsorption/ Ion Exchange Wastewater Treatment Options
Partitioning of Toxic Organic Compounds on	Aug 87). W89-02786 5D	for Sunflower AAP NQ Wastewater Treatment
Municipal Wastewater Treatment Plant Solids, W89-02299 5D	Pretreatment in Chemical Water and	Facility, W89-02828 5D
Microtox Assessment of Anaerobic Bacterial	Wastewater Treatment. W89-02791 5G	It's Your Choice: A Guidebook for Local Offi-
Toxicity, W89-02301 5D	Pretreatment of Industrial Wastewater: Legal	cials on Small Community Wastewater Manage- ment Options.
Respiration-Based Evaluation of Nitrification In-	and Planning AspectsA Case Study, W89-02800 5D	W89-02838 5D
hibition Using Enriched Nitrosomonas Cultures, W89-02302 7B	Clean Technology in the Netherlands: The Role	Waste Minimization Audit Report: Case Studies of Minimization of Solvent Wastes and Electro-
Assessment of the Degree of Treatment Re-	of the Government, W89-02801 5G	plating Wastes at a DOD (Department of De- fense) Installation,
quired for Toxic Wastewater Effluents, W89-02303 5D	Synergistic Approach to Physical-Chemical	W89-02839 5D
8th AESF/EPA Conference on Pollution Con-	Wastewater Pretreatment in the Food Industry, W89-02802 5D	Handbook: Improving POTW Performance Using the Composite Correction Program Ap-
trol for the Metal Finishing Industry. W89-02392 5G	Separation of Heavy Metals from Effluents by	proach,
ít.	Flotation,	W89-02845 5D
Pilot Scale Results of Metal Value Recovery from Mixed Metal Hydroxide Sludges,	W89-02803 5D Pretreatment of Wastewater from the Automo-	Composting of Municipal Wastewater Sludges W89-02855 5D
W89-02394 5D	bile Industry,	
Plating Waste Sludge Metal Recovery, W89-02395 5D	W89-02804 5D	Assimilative Capabilities of Retention Ponds, W89-02856 5D
Treatment of Aqueous Metal Bearing Hazardous	Industrial Wastewater Pretreatment of a Dental- Pharmaceutical Company,	Selection Guide for Volatilization Technologies
Wastes, W89-02396 5D	W89-02805 5D	for Water Treatment, W89-02863 5F
	Membrane Separation Processes for Industrial	Municipal Wastewater Sludge Combustion
Why Not Simplify Wastewater Compliance, W89-02397 5D	Effluent Treatment, W89-02806 5D	Technology. W89-02872 Situage Combustion Technology.
Pollution Control Using Room Temperature	Alternative Treatment of De-Icing Fluids from	
Evaporators, W89-02400 5G	Airports, W89-02807 5D	Biotreatment Systems: Volume I. W89-02914 5D
Howard Plating Clean Up Their Act with Mag-	Separators and Emulsion Separation Systems for	Aerobic Treatment of Sewage from Lignit
nesium Hydroxide, W89-02401 5D	Petroleum, Oil, and Lubricants, W89-02808 5D	(Brown Coal) Processing, W89-02915 5I
Metal Finishing Wastewater Treatment Upgrade with an Insoluble Sulfide Precipitation Process,	Chemical Treatment of Flue Gas Washing Liq- uids,	Treatment of Hazardous Wastes in a Sequencing Batch Reactor,

WASTEWATER TREATMENT

Anaerobic Degradation of Phenolic Compounds with Applications to Treatment of Industrial	Preliminary Design Report of a 10-MGD Deep Shaft-Flotation Plant for the City of Bangor,	Biological Wastewater Treatment of Azo Dyes, W89-03327 5D
Waste Waters, W89-02918 5D	Maine, USA: Appendix. W89-02996 5D	Stringfellow Leachate Treatment with RBC, W89-03328 5D
Biological Treatment of Toxic Industrial Waste, W89-02919 5D	Comparison Between Waste Water Treatment in Completely Mixed and Fluidized Bed Reactors:	WASTEWATER TREATMENT FACILITIES
Microbial, Chemical, and Technological Aspects	Development and Structure of Biomass (Verg- leich der Absasserreinigung im Ruhr - und im	Patapsco Wastewater Treatment Plant Toxicity Reduction Evaluation,
of the Anaerobic Degradation of Organic Pollut- ants,	Wirbelbettreaktor Sowie Entwicklung und Struktur der Biomasse),	W89-02300 5D
W89-02920 5D	W89-03045 5D	Supplemental Final Development Document for Effluent Limitations Guidelines, New Source
Biotreatment Systems: Volume II. W89-02921 5D	VYREDOX and NITREDOX Methods of In situ Treatment of Groundwater,	Performance Standards and Pretreatment Standards for the Leather Tanning and Finishing
Toxicity of Heavy Metals to Thermophilic An-	W89-03091 5F	Point Source Category. W89-02832 6E
aerobic Digestion, W89-02922 5D	Belt Filter Press Dewatering of Wastewater Sludge.	Value Engineering for Small Communities.
	W89-03099 5D	W89-02865 6B
Role of Phenolic and Humic Compounds in Anaerobic Digestion Processes,	Dye-Sensitized Photochemical Reduction of	Emissions and Control of Offensive Odor in Wastewater Treatment Plants,
W89-02924 5D	PCBs, W89-03101 5D	W89-02962 5D
Bacterial Leaching of Heavy Metals from An-	W 69-03101	
aerobically Digested Sludge, W89-02925 5D	Offline Bioregeneration of Granular Activated Carbon,	Preliminary Design Report of a 10-MGD Deep Shaft-Flotation Plant for the City of Bangor,
Biodegradation of Recalcitrant Industrial	W89-03103 5D	Maine, USA: Appendix. W89-02996 5D
Wastes,	Pilot-Plant Evaluations of Porous Biomass Sup-	W 69-02990
W89-02926 5D	ports, W89-03104 5D	WATER ALLOCATION Water and Arid Lands of the Western United
Biotreatment Systems: Volume III.		States.
W89-02927 5D	Experimental Study of Flow in Settling Tanks,	W89-02630 6D
Anaerobic Biological Process for the Prevention	W89-03107 8B	Central Valley of California,
of Noxious Odors in Pulp Manufacturing, W89-02928 5D	Thermophilic Anaerobic Digestion of Winery Waste (Vinasses): Kinetics and Process Optimi-	W89-02633 6D
Provided for Transport of Warrantees Organia	zation,	WATER ANALYSIS
Potential for Treatment of Hazardous Organic Chemicals with Biological Processes,	W89-03114 5D	Gas Chromatographic Residue Patterns of Toxa- phene in Fish Samples from the Great Lakes and
W89-02929 5D	Syntrophic Bacteria Process to Convert a Pulp Mill's Spent Sulphite Liquor to Hydrogen Sul-	from Rivers of the Southeastern United States, W89-02328 5B
Anaerobic Treatment of Sulfate-Containing	phide,	
Waste Water, W89-02930 5D	W89-03115 5D	Performance of Analytical Test Kits on Metal Finishing Wastewater Samples,
Enhanced Biological Phosphorus Removal from	Influence of Na and Ca Alkalinity on UASB Treatment of Olive Mill Effluents: I. Preliminary	W89-02403 5D
Waste Waters, W89-02931 5D	Results, W89-03116 5D	National Surface Water Survey, Western Lake Survey (Phase I - Synoptic Chemistry) Quality
Engineering/Cost Evaluation of Options for Re-	Unit Process Tradeoffs for Combined Trickling	Assurance Plan, W89-02413 2H
moval/Disposal of NC Fines,	Filter and Activated Sludge Processes,	
W89-02933 5D	W89-03160 5D	Application of XAD-4 Solid Sorbent and HPLC with Electrochemical Detection to the Analysis
Fate of Water Soluble Azo Dyes in the Activat- ed Sludge Process,	Anaerobic Fluidized Bed Treatment of an Indus- trial Wastewater,	of Phenols in Water, W89-02420 5A
W89-02935 5D	W89-03162 5D	
Computer Aided Design of Diffused Aeration Systems,	Enhanced Secondary Treatment Incorporating	External Quality-Assurance Results for the Na- tional Atmospheric Deposition Program and Na- tional Trends Network During 1986,
W89-02947 5D	Biological Nutrient Removal, W89-03163 5D	W89-02463 70
Evaluation of Biological Treatment of Pharma-	Toxicity of Selected RCRA Compounds to Ac-	Results of Intercomparison Studies for the Meas
ceutical Wastewater with PAC Addition. Volume I,	tivated Sludge Microorganisms, W89-03165 5D	urements of pH and Specific Conductance a National Atmospheric Deposition Program/Na
W89-02948 5D		tional Trends Network Monitoring Sites, Octo
Evaluation of Biological Treatment of Pharma- ceutical Wastewater with PAC Addition.	Role of Protozoa in Microbial Acclimation for Mineralization of Organic Chemicals in Sewage,	ber 1981-October 1985, W89-02485
Volume II - Appendices,	W89-03283 5D	Alkalinity Measurements in Karst Water Stud
W89-02949 5D	Membrane Separation Technologies for Treat- ment of Hazardous Wastes,	ies, W89-02729 2F
Development of an Innovative and Cost-Effec-	W89-03284 5D	
tive Municipal-Industrial Waste Treatment System,	Promising Technologies for the Biological De-	Water Analysis: A Practical Guide to Physico Chemical, Chemical and Microbiological Wate
W89-02960 5D	toxification of Hazardous Waste, W89-03322 5D	Examination and Quality Assurance, W89-02777 71
Recent Advances in Magnetic Processes,		
W89-02961 5D	Municipal Wastewater Treatment Technology Transfer Activities of the United States Environ-	Chemical and Biological Survey of Lakes and Streams Located in the Emerald Lake Water
Emissions and Control of Offensive Odor in		shed, Sequoia National Park,
Wastewater Treatment Plants,	W89-03325 5D	W89-02852 2F
W89-02962 5D	BOD and Nutrient Removal by Biological A/O	Two Test Procedures for Radon in Drinking
Flotation Processes,	Process Systems,	Water: Interlaboratory Collaborative Study,
W89-02975 5D	W89-03326 5D	W89-02956 5A

Simplified Laboratory Procedures for DO De- termination (APHA/AWWA/ WPCF Method), W89-02958 7B	ture and Soil Chemistry over a Hillslope Hollow and Spur, W89-02906 2J	Great American Desert Transformed: Aridity, Exploitation, and Imperialism in the Making of the Modern American West,
Determination of Traces of Thallium in Various Matrices.	Characterization of Colloids in Groundwater, W89-02998 2K	W89-02632 6D
W89-03067 5A	Kinetic Control of Dissolved Phosphate in Natu-	Central Valley of California, W89-02633 6D
Extraction, Clean-up and Group Separation Techniques in Organochlorine Trace Analysis,	ral Rivers and Estuaries: A Primer on the Phos- phate Buffer Mechanism.	Growth and Water in the South Coast Basin of
W89-03068 5A	W89-03253 2K	California, W89-02636 6D
Comparison of In Situ Estimates of Chlorophyll a Obtained with Whatman GF/F and GF/C	Trace Metal Transport in a Tropical Estuary, W89-03276 2L	WATER DEMANDS
Glass-Fiber Filters in Mesotrophic to Hypereu-	Iodine Speciation in Chesapeake Bay Waters,	New Water Policies for the West, W89-02639 6D
tophic Lakes, W89-03217 7B	W89-03277 2L	WATER DISTRIBUTION
New Porous Polymer for Off-Line Preconcen-	Mass Balance of Heavy Metals in the Seto Inland Sea, Japan,	Extended Period Simulation of Water Systems Direct Solution,
tration of Chlorophenols from Water, W89-03286 5A	W89-03278 5B	W89-03106 5F
Capillary Gas Chromatographic Determination	WATER CIRCULATION	WATER LAW
of Amitrole in Water with Alkali Flame Ioniza- tion Detection.	Dynamic Control by Topography in Estuaries, W89-02684 2L	Use of a Regional Ground-Water Flow Model for Water Rights Administration in a Southwest
W89-03287 5A	Circulation Anomalies in Tropical Australian Estuaries.	Alluvial Basin, W89-02332 4B
Analysis of Volatile Halogenated Hydrocarbons	W89-02697 2L	Implications of the Clean Water Act and Safe
on the ppq Scale, W89-03301 5A	I-664 Bridge-Tunnel Study, Virginia Sedimenta-	Drinking Water Act Legislation for Southwest-
Comparative Study of Different Techniques for	tion and Circulation Investigation, W89-02875 4C	ern Indian Tribes: Water-Quality Management and Indian Self Determination,
Nitrate Determination in Environmental Water	SPREX Hydrographic Data Report, Volume 3	W89-02334 5G
Samples, W89-03302 5A	- Chlorophyll and Nutrients, W89-03323 2L	Impacts of Recharge Legislation on Groundwater Management in Arizona,
Determination of Tin in Environmental Samples	WATER CONSERVATION	W89-02336 4E
by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrome- try,	Land and Water Management Issues: Texas High Plains,	Statewide Groundwater Quality Monitoring Network Design,
W89-03303 5A	W89-02634 6D	W89-02343 5A
Concentration of Mycobacterium avium by Hospital Hot Water Systems, W89-03304 5B	Water Conservation for More Crop Production in the Great Plains, W89-02657 3F	Great American Desert Transformed: Aridity Exploitation, and Imperialism in the Making of the Modern American West,
WATER BIRDS	Ground Water Conservation Techniques: Poten-	W89-02632 6E
Birds, W89-02772 2L	tial Impacts on Water Usage and Quality, W89-02658 3F	Central Valley of California, W89-02633 6E
WATER CHEMISTRY	Conservation of South African Rivers,	Water Resources of the Upper Colorado Rive
National Surface Water Survey, Western Lake Survey (Phase I Synoptic Chemistry) Quality	W89-02985 2H	Basin: Problems and Policy Alternatives, W89-02635
Assurance Plan,	Conservation Aims, Criteria, and Goals for Rivers,	
W89-02413 2H	W89-02987 2H	Conjunctive Use of Surface and Ground Wate in the South Platte, River Basin: A Case Study
Physical, Chemical, and Biological Characteris- tics of Lake Sharpe, South Dakota, 1966-1975,	Conservation Management Options for Rivers, W89-02989 6A	of the Central Colorado Water Conservance District,
W89-02424 2H	River Conservation - Implications for Legisla-	W89-02659 6I
Concept of Electron Activity and its Relation to	tion,	WATER LEVEL
Redox Potentials in Aqueous Geochemical Sys- tems,	W89-02992 6E	Selected Groundwater Information for the Co lumbia Plateau Regional Aquifer System, Wash
W89-02580 2K	WATER CONVEYANCE Appendicitis Epidemic Following Introduction	ington and Oregon, 1982-1985: Volume II Water Levels,
Controls on the Composition of Authigenic Per- colation Water in the Burren, Ireland,	of Piped Water to Anglesey, W89-03041 5F	W89-02573 76
W89-02730 2K	WATER CURRENTS	Water Level Measurements 1981-85 and Chem
Kamenitzas of Gait Barrows National Nature Reserve, North Lancashire, England,	Dispersion in Shallow Estuaries, W89-02685 2L	cal Analyses 1978-85, Red River Alluvial Aqu fer, Red River Valley, Louisiana, W89-02582
W89-02741 2F	Modeling of Tidally Induced Residual Currents,	
Dynamics of Water Chemistry in Hardwood and Pine Ecosystems,	W89-02690 2L	Historical Basis for Limits on Lake Superior Water Level Regulations,
W89-02900 2K	WATER DEMAND Projections of Water Availability in the Lower	W89-03173 4.
Variable Solute Sources and Hydrological Path- ways in a Coastal Subalpine Environment, W89-02901 2K	Rio Grande, Gila-San Francisco and Mimbres Drainage Basins to 2005,	WATER-LEVEL FLUCTUATIONS Groundwater Withdrawals and Changes in Groundwater Quality and Land Surface Subside
	Water and Anid Londo of the Western Heised	ence in the Houston District, Texas, W89-02519 66
Hydrochemical Characteristics of a Dartmoor Hillslope,	Water and Arid Lands of the Western United States.	Effects of Fluctuating River-Pool Stages of
W89-02903 2E		Groundwater Levels in the Adjacent Alluvi
Patterns of Hillslope Solutional Denudation in Relation to the Spatial Distribution of Soil Mois-		Aquifer in the Lower Arkansas River, Arkansa W89-02561

WATER-LEVEL FLUCTUATIONS

Rising Level of the Great Salt Lake: Impacts and Adjustments, W89-03127 6F	Environmental Management of the Zambezi River System, W89-03144 5G	Chronic Effects of Contaminated Sediment on Daphnia magna and Chironomus tentans, W89-03312 5C
W89-03127 6F	W89-03144 3G	W 89-03312
Responses of Four Irish Wetland Tree Species to Raised Soil Water Levels, W89-03128 2H	Attempt to Facilitate Water Management Issues in the Zambezi River Basin Using Decision Sup-	WATER POLLUTION CONTROL Patapsco Wastewater Treatment Plant Toxicity Reduction Evaluation,
W89-03128 2H	port Systems, W89-03145 5G	W89-02300 5D
Radial Stem Growth of Coniferous Trees near Swedish Reservoirs,	WATER POLICY	Impact of the Newport-Inglewood Structural
W89-03142 6G	Water and Arid Lands of the Western United	Zone on Hydrogeologic Mitigation Efforts: Los
WATER LEVEL RECORDERS Groundwater Levels in Wyoming, 1978	States. W89-02630 6D	Angeles Basin, California, W89-02342 2F
Through September 1987,	Central Valley of California,	8th AESF/EPA Conference on Pollution Con-
W89-02468 4B	W89-02633 6D	trol for the Metal Finishing Industry. W89-02392 5G
WATER LEVEL RECOVERY	Land and Water Management Issues: Texas	
Recovery of Moisture/Solute Profiles in Re- claimed Coal-Mine Spoil, Northwest New	High Plains, W89-02634 6D	Hazardous Waste Research Pertaining to Metal Finishing,
Mexico, W89-02360 2F	Water Resources of the Upper Colorado River	W89-02393 5G
W 89-02300 21	Basin: Problems and Policy Alternatives,	Pollution Control Using Room Temperature
WATER LEVELS	W89-02635 6D	Evaporators,
Records of Wells, Drillers' Logs, Water Level	Court and Water in the South Coast Basin of	W89-02400 5G
Measurements, and Chemical Analyses of Groundwater in Harris and Galveston Counties,	Growth and Water in the South Coast Basin of California,	Howard Plating Clean Up Their Act with Mag- nesium Hydroxide,
Texas 1980-84, W89-02497 7C	W89-02636 6D	W89-02401 5D
	Toward Sustaining a Desert Metropolis: Water	Defended to the Late of the African Maria
Description of Piezometer Nests and Water Levels in the Rio Grande Valley Near Albu-	and Land Use in Tucson, Arizona,	Performance of Analytical Test Kits on Metal Finishing Wastewater Samples,
querque, Bernalillo County, New Mexico,	W89-02637 6D	W89-02403 5D
W89-02509 2F	Water Management Issues in the Denver, Colo-	Analysis of Agricultural Nonpoint Pollution
Groundwater Withdrawals and Changes in	rado, Urban Area, W89-02638 6D	Control Options in the St. Albans Bay Water-
Groundwater Quality and Land Surface Subsid-		shed, W89-02419 5G
ence in the Houston District, Texas, W89-02519 6G	New Water Policies for the West, W89-02639 6D	
		Effects of Runoff Controls on the Quantity and
Map Showing Groundwater Levels in Anchorage, Alaska, 1985,	Developing a State Ground Water Policy in the Corn Belt: the Iowa Case,	Quality of Urban Runoff at Two Locations in Austin, Texas,
W89-02526 7C	W89-02681 2F	W89-02518 5B
WATER MANAGEMENT	Rising Level of the Great Salt Lake: Impacts	Soil Testing As a Guide to Prudent Use of
Proceedings, Seventeenth Mississippi Water Re- sources Conference, 25-26 March, 1987, Jackson,	and Adjustments, W89-03127 6F	Nitrogen Fertilizers in Oklahoma Agriculture, W89-02664 7B
Mississippi.	W 65-03127 01	Accessing Same Between Sec Character Acces
W89-02476 6B	WATER POLLUTION	Assessing Some Potentials for Changing Agro- nomic Practices and Improving Ground Water
West in Profile,	Metal Speciation: Theory, Analysis and Applica- tion.	Quality: Implications from a 1984 Iowa Survey,
W89-02631 6D	W89-02640 5B	W89-02669 5G
Central Valley of California,	Treatment of Hazardous Wastes in a Sequencing	Incentives and Institutions to Reduce Pesticide
W89-02633 6D	Batch Reactor,	Contamination of Ground Water,
Land and Water Management Issues: Texas	W89-02917 5D	W89-02677 5G
High Plains,	Biotreatment Systems: Volume III.	Developing a State Ground Water Policy in the
W89-02634 6D	W89-02927 5D	Corn Belt: the Iowa Case, W89-02681 2F
Water Resources of the Upper Colorado River	In Situ Biological Groundwater Denitrification:	
Basin: Problems and Policy Alternatives, W89-02635 6D	Concepts and Preliminary Field Tests,	Clean Technology in the Netherlands: The Role of the Government,
	W89-03097 5G	W89-02801 5G
Growth and Water in the South Coast Basin of California.	Reversibility of Acidification Shown by Whole-	Corrective Measures for Releases to Ground-
W89-02636 6D	Catchment Experiments,	water from Solid Waste Management Units,
Toward Sustaining a Desert Metropolis: Water	W89-03120 5B	W89-02844 5G
and Land Use in Tucson, Arizona,	Contaminated Aquifers are a Forgotten Compo-	Ambient Water Quality Criteria for Chloride -
W89-02637 6D	nent of the Global N2O Budget, W89-03121 5B	1988,
Water Management Issues in the Denver, Colo-		W89-02860 5G
rado, Urban Area,	Recent Acidification of a Large Scottish Loch Located Partly within a National Nature Re-	Control of Volatile Organic Contaminants in
W89-02638 6D	serve and Site of Special Scientific Interest,	Groundwater by In-Well Aeration, W89-02955 5F
New Water Policies for the West,	W89-03125 5C	
W89-02639 6D	Bacterial Loadings from Resuspended Sediments	Biodegradation Modeling at Aviation Fuel Spill Site.
Fish Populations of a Small Lowland Channel-	in Recreational Beaches,	W89-03100 5G
ized River in England Subject to Long-Term River Maintenance and Management Works,	W89-03136 5B	
W89-03139 6G	Estuaries: Concern Over Troubled Waters,	Leachate Collection in Landfills: Steady Case, W89-03102 5E
	W89-03279 7A	
Mathematical Hydraulic Model of the River Nene - a Canalized, and Heavily Controlled	Effects of Cadmium Exposure on Feeding of	Influence of Nutrient Enrichment and Light Availability on the Abundance of Aquatic Ma-
River,	Freshwater Planktonic Crustaceans,	crophytes in Florida Streams,
W89-03141 4A	W89-03288 5C	W89-03231 5C

Responses to Acidic Deposition in Ombotrophic	tions/Facilities in the Chesapeake Bay Region.	Fluxes and Ion Balance in the Brook Trout
Mires in the U.K., W89-02314 5B	Phase III Report. Volume 1 - Summary. W89-02953 5C	(Salvelinus fontinalis), W89-03235 5C
Strategies for Long-Term Pollution Monitoring of the Coastal Oceans,	Water Quality Assessment of DOD Installa- tions/Facilities in the Chesapeake Bay Region.	Blood Gases, Acid-Base Status, Ions, and Hema- tology in Adult Brook Trout (Salvelinus fontina-
W89-02319 5A	Phase III Report. Volume 2 - Overall Approach, Findings and Recommendations.	lis) Under Acid/Aluminum Exposure, W89-03236 5C
Proceedings of the FOCUS Conference on Southwestern Ground Water Issues.	W89-02954 5C	Physiological Evidence of Acclimation to Acid/
W89-02331 2F	Cumulative Impact Assessment: Issues to Con- sider in Selecting a Cumulative Assessment	Aluminum Stress in Adult Brook Trout (Salve- linus fontinalis): I. Blood Composition and Net
Modeling the Response of Lake-Aquifer Sys- tems to Acid Precipitation,	Method, W89-02965 5C	Sodium Fluxes, W89-03237 5C
W89-02341 5C		
Effects of Acid Mine Drainage on Groundwater Quality at the Leviathan Sulfur Mine, Alpine County, California,	Uses of, and Human Impact on Rivers, W89-02988 4C	Physiological Evidence of Acclimation to Acid/ Aluminum Stress in Adult Brook Trout (Salve- linus fontinalis): II. Blood Parameters by Cannu-
W89-02363 5C	Aquatic Macrophytes in Adirondack (New York) Lakes: Patterns of Species Composition in	lation, W89-03238 5C
Water Quality Data for the Boise River, Boise to Star, Idaho, October to December 1987,	Relation to Environment, W89-03056 5C	Sodium Transport in the Brook Trout, Salve-
W89-02464 5C	Predicting the Effects of a Pesticide Release to	linus fontinalis: Effects of Prolonged Low pH Exposure in the Presence and Absence of Alu-
Effects of Organic Wastes from Processing of Green River Formation Oil Shale on Water	the Rhine River, W89-03159 5C	minum, W89-03239 5C
Quality, W89-02487 5B	Acute Toxicity of Malathion, Tetrabromobis-	Effects of Low pH and Aluminum on Ventila-
Effects of Heavy Metal Pollution on Epilithic	phenol-A, and Tributyltin Chloride to Mysids (Mysidopsis bahia) of Three Ages,	tion in the Brook Trout (Salvelinus fontinalis), W89-03240 5C
Bacteria, W89-02552 5C	W89-03203 5C	Effect of Long-Term Exposure to Acid, Alumi-
Transport, Bioaccumulation, and Toxicity of	Effects of Water Soluble Crude Oil Fractions on Cirral Beat Frequency in Balanus balanoides, W89-03205 5C	num, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): I. Survival, Growth, Fe-
Metals and Metalloids in Microorganisms under Environmental Stress,	Effect of Temperature on the Chronic Toxicity	cundity, and Progeny Survival, W89-03241 5C
W89-02652 5B	of Hydrothol-191 to the Fathead Minnow (Pi-	Effect of Long-Term Exposure to Acid, Alumi-
North Alabama Water Quality Assessment, Volume VIII - Water Quality Modeling, W89-02702 5B	mephales promelas), W89-03206 5C	num, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Os- moregulation,
Pesticide Impact on Stream Fauna with Special	Effect of Assam Crude on Photosynthesis and Associated Electron Transport System in Ana-	W89-03242 5C
Reference to Macroinvertebrates, W89-02773 5C	baena doliolum, W89-03207 5C	Morphometric Changes in Gill Secondary La- mellae of Brook Trout (Salvelinus fontinalis)
Organic Chemicals in Natural Waters: Applied	Diflubenzuron Application to Citrus and Its	after Long-Term Exposure to Acid and Alumi- num,
Monitoring and Impact Assessment, W89-02776 5C	Impact on Invertebrates in an Adjacent Pond, W89-03208 5C	W89-03243 5C
Summary of Maryland Stream pH and Alkalini-	Acute Toxicity of Binary Mixtures of Five Ca-	Effects of Cadmium Exposure on Feeding of Freshwater Planktonic Crustaceans,
ty Data: Analysis of Its Application to Assessing the Impacts of Acidic Deposition,	tions $(Cu(2+), Cd(2+), Zn(2+), Mg(2+), and K(+))$ to the Freshwater Amphipod Gammarus	W89-03288 5C
W89-02840 5C	lacustris (Sars): Alternative Descriptive Models, W89-03212 5C	Effects of Cadmium on Consumption, Assimila- tion and Biochemical Parameters of Daphnia
Intensive Survey of the Kishwaukee River and its Tributaries, 1983.	Effect of pH on Speciation and Toxicity of	magna: Possible Implications for Reproduction, W89-03289 5C
W89-02858 5C	Aluminum to Rainbow Trout (Salmo gairdneri), W89-03213 5C	Impairment of Mobility and Development in
Ambient Water Quality Criteria for Chloride - 1988,	Accumulation of Cadmium by Rainbow Trout,	Freshwater Snails (Physa fontinalis and Lym- naea stagnalis) Caused By Herbicides,
W89-02860 5G	Salmo Gairdneri, During Extended Exposure, W89-03220 5B	W89-03290 5C
Survey of Sensitivity of Southern California Lakes to Acid Deposition,	Growth, Fecundity, and Energy Stores of White	Chronic Effects of Cu on Reproduction of Poly- pedilum nubifer (Chironomidae) through Water
W89-02864 5C	Sucker (Catostomus commersoni) from Lakes	and Food,
Health and Environmental Effects Profile for 1,2,3,4,5-Penta-Bromo-6-Chlorocyclohexane.	Containing Elevated Levels of Copper and Zinc, W89-03225 5C	W89-03296 5C
W89-02866 5C	Copper Intoxication in Chinook Salmon (Oncor-	Review of Environmental Toxicity of Quater nary Ammonium Halides,
Preliminary Environmental Assessment of the Contamination Associated with Lake Calumet,	hynchus Tshawystscha) Induced by Natural Springwater: Effects on Gill Na(+), K(+)-	W89-03298 50
Cook County, Illinois, W89-02870 5B	ATPase, and Plasma Glucose, W89-03228 5C	Asbestos-Contaminated Drinking Water: It Impact on Household Air,
Causes of Wetland Loss in the Coastal Central	Comparison of Phosphorus Dynamics in Two	W89-03299 5I
Gulf of Mexico. Volume 2: Technical Narrative. W89-02878 4C	Oklahoma Reservoirs and a Natural Lake Vary- ing in Abiogenic Turbidity,	Effects of Simulated Acid Rain on Sugar Maple Seedling Root Growth,
Toxicity of DEGDN, Synthetic-HC Smoke	W89-03232 2H	W89-03300 50
Combustion Products, Solvent Yellow 33 and Solvent Green 3 to Freshwater Aquatic Orga-	Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft	Results of a Short-Term Toxicity Study for Three Organic Chemicals Found in Niagar
nisms,	Pulp Mill Effluents, W89.03234	River Drinking Water, W89-03310

WATER POLLUTION EFFECTS

	41 W 41 -1 4 W 12 A 1 MW -1	C-1-1-1 1 C
Chronic Effects of Contaminated Sediment on Daphnia magna and Chironomus tentans,	Air Pollution and Soil Acidification, W89-02306 5B	Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama;
W89-03312 5C	Discussion of the Changes in Soil Acidity Due	Area 9, W89-02563 5B
Acute Toxicity and Behavioral Effects of Acry- lates and Methacrylates to Juvenile Fathead	to Natural Processes and Acid Deposition, W89-02307 5B	Geohydrology and Susceptibility of Major
Minnows, W89-03313 5C	Soil Acidification and Metal Solubility in For-	Aquifers to Surface Contamination in Alabama;
In Vivo and In Vitro Effect of Triclorfon on	ests of Southern Sweden,	Area 8, W89-02564 5B
Esterases of the Red Crayfish Procambarus clar-	W89-02308 5B	Geohydrology and Susceptibility of Coldwater
kii, W89-03314 5C	Differences in Aluminum Mobilization in Spodo- sols in New Hampshire (USA) and in the Neth-	Spring and Jacksonville Fault Areas to Surface Contamination in Calhoun County, Alabama,
Toxicity of Six Heterocyclic Nitrogen Com-	erlands as a Result of Acid Deposition, W89-02309 5B	W89-02576 5B
pounds to Daphnia pulex, W89-03315 5C		Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama,
Evaluation of the Acute Toxicity to Juvenile	Interactions of Sphagnum with Water and Air, W89-02312 2H	Area 7,
Pacific Salmonids of Hexazinone and its Formulated Products: Pronone 10G, Velpar L, and	Responses to Acidic Deposition in Ombotrophic	W89-02577 5B
Their Carriers,	Mires in the U.K.,	Geohydrology and Susceptibility of Major
W89-03316 5C	W89-02314 5B	Aquifers to Surface Contamination in Alabama, Area 1,
Portable Environment Test System: A Field As-	Stratigraphic Record of Atmospheric Loading	W89-02578 5B
sessment of Organotin Leachates. Test and Eval-	of Metals at the Ombrotrophic Big Heath Bog,	U.S. Geological Survey Urban-Stormwater Data
uation, W89-03324 5C	Mt. Desert Island, Maine, U.S.A., W89-02315 5B	Base of Constituent Storm Loads; Characteris- tics of Rainfall, Runoff, and Antecedent Condi-
Chlorine Sensitivity of Early Life Stages of	Assessment of the Adequacy of the Ground-	tions; and Basin Characteristics,
Freshwater Fish, W89-03333 5C	Water Monitoring System for Artificial Re-	W89-02581 7C
	charge of Aquifers in the Los Angeles Area, California,	Geohydrology and Susceptibility of Major
VATER POLLUTION PREVENTION	W89-02335 7A	Aquifers to Surface Contamination in Alabama,
8th AESF/EPA Conference on Pollution Con- trol for the Metal Finishing Industry.	Dry Wells - Solution or Pollution: An Arizona	Area 6, W89-02590 5B
W89-02392 5G	Status Report,	
Hazardous Waste Research Pertaining to Metal	W89-02338 5B	Calibration of a Dissolved-Solids Model for the Yampa River Basin Between Steamboat Springs
Finishing, W89-02393 5G	Field Simulation of Waste Impoundment Seep-	and Maybell, Northwestern Colorado, W89-02591 5B
Liability for Managing Hazardous Wastes: Past,	age in the Vadose Zone, W89-02348 5B	
Present and Future, W89-02398 6E	Hydrogeologic and Geochemical Aspects of	Ground Water Contamination from Saltwater Intrusion And Limitations on Agricultural Ac-
	Contaminant Transport at the Falls City, Texas	tivities, W89-02662 5B
Successful In House Recovery of Solvent, W89-02410 5G	UMTRA Site, W89-02362 5B	Impacts of Agricultural Chemicals on Ground
Efficient Nitrogen Fertilization in Agricultural	Effects of Acid Mine Drainage on Groundwater	Water Quality in Iowa,
Production Systems, W89-02665 5B	Quality at the Leviathan Sulfur Mine, Alpine	W89-02668 5E
	County, California, W89-02363 5C	Saline Seep on Wheatland in Northwest Oklaho-
Poultry Manure Management and Ground Water Quality: The Delaware Solution,		ma, W89-02672 5E
W89-02678 5G	Design of a Great Lakes Atmospheric Inputs and Sources (GLAIS) Network,	
Pretreatment of Industrial Wastewater: Legal	W89-02418 7A	North Alabama Water Quality Assessment Volume VIII - Water Quality Modeling,
and Planning AspectsA Case Study, W89-02800 5D	Hydrology of Area 27, Eastern Region, Interior	W89-02702 5E
Pre-Precipitation for Improvement of Nitrogen	Coal Province, Illinois, W89-02484 5B	Evaluation of Rain Chemistry Data for the John
Removal in Biological Wastewater Treatment,		F. Kennedy Space Center, Florida and the University of Central Florida, Orlando, Florida,
W89-02812 5D	Effects of Organic Wastes from Processing of Green River Formation Oil Shale on Water	W89-02708 40
Lake Erie Conservation Tillage Demonstration	Quality,	Pesticide Impact on Stream Fauna with Specia
Projects: Evaluating Management of Pesticides,	W89-02487 5B	Reference to Macroinvertebrates,
Fertilizer, Residue to Improve Water Quality. W89-02837 3F	Supplemental Arsenic Data for Selected Streams	W89-02773 50
Evaluation of Municipal Solid Waste Landfill	in the Missouri River Basin, Montana, 1987,	Organic Chemicals in Natural Waters: Applied
Cover Designs,	W89-02516 5B	Monitoring and Impact Assessment, W89-02776 50
	Effects of Runoff Controls on the Quantity and Quality of Urban Runoff at Two Locations in	Acid Precipitation. Citations from the COM
Aerobic Treatment of Sewage from Lignite (Brown Coal) Processing.	Austin, Texas,	PENDEX Engineering Information Inc. Data
W89-02915 5D	W89-02518 5B	base (Sept 84 - Aug 86). W89-02784 51
Literature Study on the Feasibility of Microbio-	Water Quality of Runoff to the Clarksville Me-	
logical Decontamination of Polluted Soils, W89-02916 5G	morial Hospital Drainage Well and of Mobley Spring, Clarksville, Tennessee, February-March	Acid Precipitation. Citations from the COM PENDEX Engineering Information Inc. Date
Leachate Collection in Landfills: Steady Case,	1988, W89-02556 5B	base (Sept 86 - Aug 87). W89-02785
W89-03102 5E	Quality of Groundwater in Shallow Wells in	Review of Papers Published in 1985 about Emis
WATER POLLUTION SOURCES	Agricultural Areas of Haywood, Shelby, Lake,	sion, Transport, Transformation and Depositio
Effects of Atmospheric Pollutants on Forests, Wetlands and Agricultural Ecosystems.	and Obion Counties, Tennessee, January-Febru- ary 1988,	of Atmospheric Trace Constituents of Impor- tance for Acid Deposition,
W89-02304 SB	W89-02557 5B	W89-02827 5.

Maryland Synoptic Stream Chemistry Survey:	Total Phosphorus Budget for Lake St. Clair:	Superfund Record of Decision: Vega Alta, PR.
Estimating the Number and Distribution of	1975-80,	W89-02984 5G
Streams Affected By or At Risk from Acidifica-	W89-03168 5B	
tion, W89-02846 5B	Horizontal and Vertical Distribution of PCBs in	Installation Restoration Program Phase II - Con- firmation/Quantification. Stage I.
	Southern Lake Michigan Sediments and the	W89-02999 5B
Intensive Survey of the Kishwaukee River and	Effect of Waukegan Harbor as a Point Source,	In Site Biological Company Desired
its Tributaries, 1983. W89-02858 5C	W89-03170 5B	In Situ Biological Groundwater Denitrification: Concepts and Preliminary Field Tests,
	Distribution of Contaminants in Clams and Sedi-	W89-03097 5G
Studies of the Mechanisms and Rates with which Nitrogen Species are Incorporated into	ments from the Huron-Erie Corridor: II. Lead and Cadmium,	Day Sanisiand Whataharian Budanian of
Cloud Water and Precipitation,	W89-03177 5B	Dye-Sensitized Photochemical Reduction of PCBs,
W89-02862 5B	F	W89-03101 5D
NAPAP Operating Research Plan: 1986-1988.	Estuaries: Concern Over Troubled Waters, W89-03279 7A	Pilot Plant Demonstration of In-situ Biodegrada-
W89-02876 5B		tion of 1,1,1-Trichloroethane,
Superfund Record of Decision: Northern En-	WATER POLLUTION TREATMENT Impact of the Newport-Inglewood Structural	W89-03164 5D
graving, WI.	Zone on Hydrogeologic Mitigation Efforts: Los	Fate and Effects of Xanthates in Laboratory
W89-02938 5B	Angeles Basin, California,	Freshwater Systems,
Water Quality Assessment of DOD Installa-	W89-02342 2F	W89-03201 5G
tions/Facilities in the Chesapeake Bay Region.	Role of Aquifer Testing in Design of Constant-	WATER POLUTION EFFECTS
Phase III Report. Volume 1 - Summary. W89-02953 5C	Head Extraction Systems,	Influence of Nutrient Enrichment and Light
	W89-02346 7B	Availability on the Abundance of Aquatic Ma-
Water Quality Assessment of DOD Installa- tions/Facilities in the Chesapeake Bay Region.	In-Situ Hydrocarbon Extraction, A Case Study,	crophytes in Florida Streams, W89-03231 5C
Phase III Report. Volume 2 - Overall Approach,	W89-02354 5G	W 67-03251
Findings and Recommendations.	Permeable Barriers: A New Alternative for	WATER POLUTION SOURCES
W89-02954 5C	Treatment of Contaminated Ground Waters,	Extraction, Clean-up and Group Separation Techniques in Organochlorine Trace Analysis,
U.S. Production of Manufactured Gases: Assess-	W89-02355 5G	W89-03068 5A
ment of Past Disposal Practices, W89-02964 5E	Use of Well Packers To Control TCE and PCE	WATER BRADERTIES
W 89-02904 3E	Contaminants,	WATER PROPERTIES Water Quality Assessment of Arvada Reservoir.
Critique of Models for Freshwater and Soil	W89-02356 5G	Denver Metropolitan Area, Colorado,
Acidification, W89-02967 5B	Design and Construction of a Subsurface Gaso-	W89-02562 2H
	line Recovery System Westminster, Colorado, W89-02357 5G	Interrelationship Between In Vivo Fluorescence
Superfund Record of Decision: Katonah Munici- pal Well, NY.		of Phytoplankton and Light Beam Transmission
W89-02979 5G	Advantages of Suction Lift Hydrocarbon Re- covery Systems: Application At Three Hydro-	with Reference to Fluorescence Yield,
Superfund Record of Decision: Independent	geologic Environments in California,	W89-03233 2L
Nail, SC.	W89-02358 5G	WATER QUALITY
W89-02980 5G	In Situ Aquifer Denitrification: Remediation of	New Approaches to Monitoring Aquatic Eco- systems.
Superfund Record of Decision: Endicott Well	Ammonia and Nitrate Contaminated Subsurface	W89-02317 5A
Field, NY.	Environments,	
W89-02983 5G	W89-02359 5G	Monitoring the Nation's WatersA New Per- spective,
Superfund Record of Decision: Vega Alta, PR.	Effects of Acid Mine Drainage on Groundwater	W89-02318 5A
W89-02984 5G	Quality at the Leviathan Sulfur Mine, Alpine County, California,	Contain for I are Town Belleties Manitosis
Acid Precipitation in North America: 1985	W89-02363 5C	Strategies for Long-Term Pollution Monitoring of the Coastal Oceans,
Annual and Seasonal Data Summaries from		W89-02319 5A
Acid Deposition System Data Base, W89-02997 5B	Superfund Record of Decision: Rockaway Bor- ough Well Field, NJ.	Innovative Designs for Water Quality Monitor
	W89-02706 5D	ing: Are We Asking the Questions Before th
Quantity and Quality of Storm Runoff from Three Urban Catchments in Bellevue, Washing-	Superfund Record of Decision: Combe Fill	Data Are Collected,
ton,	North Landfill, NJ.	W89-02320 7A
W89-03000 5B	W89-02707 5G	Review of the Crater Lake Limnological Pro
Results of Experiments Related to Contact of	Literature Study on the Feasibility of Microbio-	grams,
Mine-Spoils Water with Coal, West Decker and	logical Decontamination of Polluted Soils,	W89-02322 21
Big Sky Mines, Southeastern Montana, W89-03001 5B	W89-02916 5G	Monitoring, Research, and Management: Inte
	Superfund Record of Decision: Northern En-	gration for Decisionmaking in Coastal Marin
Atmospheric, Geological, Marine, and Anthro-	graving, WI.	Environments, W89-02323 5/
pogenic Effects on Groundwater Quality in Fin- land,	W89-02938 5B	
W89-03076 5B		Multidecade Trend-Monitoring Program for Chesapeake Bay, A Temperate East Coast Estu
Microbial Activity in Sanitary Landfills: A Pos-	Approach, W89-02966 5G	ary,
sible Source of the Humic Substances in		W89-02324 . 7/
Groundwater,	Superfund Record of Decision: Katonah Munici-	Coastal Monitoring: Evaluation of Monitorin
W89-03079 5B	pal Well, NY. W89-02979 5G	Methods in Narragansett Bay, Long Islan
Groundwater Contamination at a Landfill Sited		Sound and New York Bight, and a General
on Fractured Carbonate and Shale, W89-03146 5B	Superfund Record of Decision: Independent Nail, SC.	Monitoring Strategy, W89-02325
	W89-02980 5G	
Groundwater Contamination by Nitrates and Chlorides Washed out from Phosphorite Ores in		'Mussel Watch'Measurements of Chemical Po- lutants in Bivalves as One Indicator of Coast
the Negev Desert, Israel,	Field, NY.	Environmental Quality,
W89-03147 5E		W89-02326 5.

WATER QUALITY

Gas Chromatographic Residue Patterns of Toxa- phene in Fish Samples from the Great Lakes and from Rivers of the Southeastern United States, W89-02328 5B	Data-Collection Methods and Data Summary for the Assessment of Water Quality in Cedar Creek, West-Central Illinois, W89-02520 7B	Ground Water Conservation Techniques: Potential Impacts on Water Usage and Quality, W89-02658 3F
	Selected Water-Quality Data for the Murtaugh	Impacts of Agricultural Chemicals on Ground
Development, Management, and Analysis of a Long-Term Ecological Research Information Base: Example for Marine Macrobenthos,	Lake Area, South Central Idaho, June 1987, W89-02530 7C	Water Quality in Iowa, W89-02668 5B
W89-02329 10D	Water Quality of Runoff to the Clarksville Me-	Assessing Some Potentials for Changing Agro- nomic Practices and Improving Ground Water
Implications of the Clean Water Act and Safe Drinking Water Act Legislation for Southwest-	morial Hospital Drainage Well and of Mobley Spring, Clarksville, Tennessee, February-March	Quality: Implications from a 1984 Iowa Survey, W89-02669 5G
ern Indian Tribes: Water-Quality Management and Indian Self Determination,	1988, W89-02556 5B	North Alabama Water Quality Assessment,
W89-02334 5G	Quality of Groundwater in Shallow Wells in	Volume VIII - Water Quality Modeling,
Modeling the Response of Lake-Aquifer Sys-	Agricultural Areas of Haywood, Shelby, Lake,	
tems to Acid Precipitation, W89-02341 5C	and Obion Counties, Tennessee, January-Febru- ary 1988,	Spirit Lake, Mount St. Helens, Washington, Limnological and Bacteriological Investigations.
	W89-02557 5B	Final Report, Volume I,
Impact of the Newport-Inglewood Structural Zone on Hydrogeologic Mitigation Efforts: Los	Water Resources Investigations in Tennessee:	W89-02709 2H
Angeles Basin, California,	Programs and Activities of the U.S. Geological	Spirit Lake, Mount St. Helens, Washington,
W89-02342 2F	Survey, 1987-1988, W89-02559 7C	Limnological and Bacteriological Investigations.
Improved Fresh Water Assessment in Sand		Final Report, Volume II, Appendices, W89-02710 2H
Aquifers Utilizing Geophysical Well Logs, W89-02347 2F	Water Quality Assessment of Arvada Reservoir, Denver Metropolitan Area, Colorado,	Emerging Issues in Surface Water Quality Re-
Water-Bearing Zones in the Mining Area of the	W89-02562 2H	search,
Northern Region of Bangladesh with Regard to	Water Resources Investigations in Tennessee:	W89-02721 5G
Utilization of Mine Water for Irrigation and	Programs and Activities of the U.S. Geological	Water Analysis: A Practical Guide to Physico-
Other Uses, W89-02369 2F	Survey, 1987-1988, W89-02570 9C	Chemical, Chemical and Microbiological Water
		Examination and Quality Assurance, W89-02777 7B
Water Quality Data for the Boise River, Boise to Star, Idaho, October to December 1987,	Water Resources Activities of the U. S. Geologi- cal Survey in Texas - Fiscal Year 1987,	
W89-02464 5C	W89-02574 9C	From Filters to Forests: Water Treatment and Supply,
Assessment of Water Quality and Factors Af-	Water Quality of Canyon Lake, Central Texas,	W89-02792 5F
fecting Dissolved Oxygen in the Sangamon	W89-02579 2H	Intensive Survey of the DuPage River Basin,
River, Decatur to Riverton, Illinois, Summer 1982,	Water Level Measurements 1981-85 and Chemi-	1983.
W89-02486 5B	cal Analyses 1978-85, Red River Alluvial Aqui-	W89-02829 5G
Effects of Organic Wastes from Processing of	fer, Red River Valley, Louisiana, W89-02582 7C	Intensive Survey of the Fox River Basin from
Green River Formation Oil Shale on Water		the Wisconsin State Line to Ottawa, Illinois: 1982.
Quality, W89-02487 5B	Groundwater Resources of Limestone County, Texas,	W89-02841 5G
	W89-02583 2F	National Surface Water Survey: National
Methods for Hydrologic Monitoring of Surface Mining in the Central-Western United States,	Calibration of a Dissolved-Solids Model for the	Stream Survey Phase I - Pilot Survey,
W89-02490 7A	Yampa River Basin Between Steamboat Springs and Maybell, Northwestern Colorado,	W89-02842 5G
Hydrology of Area 62, Northern Great Plains	W89-02591 5B	Chemical and Biological Survey of Lakes and Streams Located in the Emerald Lake Water-
and Rocky Mountain Coal Provinces-New Mexico and Arizona,	Surface Water Quality Characteristics in the	shed, Sequoia National Park,
W89-02498 2F	Upper North Fork Gunnison River Basin, Colo-	W89-02852 2H
Hydrology of Area 59, Northern Great Plains	rado, W89-02593 5B	Intensive Survey of the Kishwaukee River and
and Rocky Mountain Coal Provinces, Colorado		its Tributaries, 1983.
and Wyoming, W89-02501 2E	Hydrology of Area 8, Eastern Coal Province, West Virginia and Ohio,	W89-02858 5C
	W89-02598 4C	Lake Michigan Water Quality Report January
Documentation for a Digital Computer Model of Nutrient and Dissolved-Oxygen Transport in	Relations of Specific Conductance to Stream-	through December, 1986. W89-02867 5B
the Truckee River and Truckee Canal Down-	flow and Selected Water Quality Characteristics	
stream from Reno, Nevada, W89-02504 5B	of the Arkansas River Basin, Colorado, W89-02599 2K	Volunteer Lake Monitoring Program, 1987. Volume I: Statewide Summary Report,
Records of Wells and Chemical Analyses of	Computer Broares Decumentation of an Inter-	W89-02869 7B
Groundwater in Hand and Hyde Counties South	Computer-Program Documentation of an Inter- active-Accounting Model to Simulate Stream-	Hydrology and Water Quality of a Drained Clay
Dakota,	flow, Water Quality, and Water-Supply Oper-	Catchment, Lockle Park, Northumberland, W89-02889 2E
W89-02505 2F	ations in a River Basin, W89-02600 7C	
Hydrology of Area 31, Eastern Region, Interior Coal Province, Illinois and Indiana.		Ohio Stream Regionalization Project: A Com- pendium of Results,
W89-02508 5B	Water Quality Data for Orwell Reservoir and the Otter Tail River Near Fergus Falls, Minne-	W89-02932 2H
Data on the Distribution and Abundance of Sub-	sota,	Treatment of Rome Raw Water by Krofta Sand-
mersed Aquatic Vegetation in the Tidal Poto-	W89-02605 5B	float Process System Project Documentation
mac River and Estuary, Maryland, Virginia, and the District of Columbia, 1986,	Metal Speciation: Theory, Analysis and Applica- tion.	(Part A), W89-02941 5F
W89-02511 7C	W89-02640 5B	
Supplemental Arsenic Data for Selected Streams	Ground Water Quality and Agricultural Prac-	Water Quality Assessment of DOD Installa- tions/Facilities in the Chesapeake Bay Region.
in the Missouri River Basin, Montana, 1987,	tices.	Phase III Report. Volume 1 - Summary.
W89-02516 5B	W89-02654 3F	W89-02953 5C

Simplified Laboratory Procedures for DO De-	on the Results of the Water System Monitoring	WATER REQUIREMENTS
termination (APHA/AWWA/ WPCF Method), W89-02958 7B	Required by House File 2303. W89-02836 5F	Projections of Water Availability in the Lower Rio Grande, Gila-San Francisco and Mimbres Drainage Basins to 2005,
Evaluation of Baseline Conditions at Lease Tract C-a, Rio Blanco County, Colorado,	Analysis of Biomonitoring Techniques to Sup- plement Effluent Guidelines.	W89-02474 6D
W89-02974 5B	W89-02994 5A	WATER RESEARCH INSTITUTE
River Response to Catchment Conditions, W89-02990 2H	Critical Assessment of the 'Dynamic Daphnia Test' (Kritische Betrachtung des 'Dynamischen	Fiscal Year 1986 Program Report (New York Water Resources Institute), W89-02471 9D
Quality of Ground Water in the Payette River Basin, Idaho,	Daphnien Tests'), W89-03046 5A	Fiscal Year 1986 Program Report (Colorado
W89-03008 5G	Application of Environmental Risk Analysis to Groundwater Protection.	Water Resources Research Institute), W89-02477 9D
Atmospheric, Geological, Marine, and Anthro- pogenic Effects on Groundwater Quality in Fin-	W89-03083 5G	Fiscal Year 1986 Program Report (Wyoming
land, W89-03076 5B	In Situ Biological Groundwater Denitrification: Concepts and Preliminary Field Tests,	Water Research Center), W89-02479 9D
Investigation into Mechanisms of Microbial Ef-	W89-03097 5G	Fiscal Year 1987 Report (Georgia Water Re-
fects on Iron and Manganese Transformations in	Comparison of Flow-Through and Towed	sources Research Institute),
Artificially Recharged Groundwater, W89-03078 4B	Fluorometers for Measuring Oil Concentrations in the Sea,	W89-02553 9D
	W89-03329 5A	Fiscal Year 1987 Program Report (North Caroli-
Index of Water Quality Permitting Environmen- tal Follow-up and Assessment of Local Impacts	WATER QUALITY DATA	na Water Resources Research Institute). W89-02554 9D
(Indice de Qualite de l'Eau Permettant le Suivi Environnemental et la Mesure des Impacts	Data on Groundwater Quality for the Millett 1	Fiscal Year 1986 Program Report (Massachu-
Locaux),	Degree X 2 Degree Quadrangle, Central Nevada,	setts Water Resources Research Center),
W89-03131 5C	W89-02533 7C	W89-02587 9D
Probability and Stochastic Modelling of Water Quality Parameters in the Thames River,	Data on Groundwater Quality for the Elko 1 Degree X 2 Degree Quadrangle, Eastern	Fiscal Year 1986 Program Report (Virgin Islands Water Resources Research Center),
W89-03135 5B	Nevada,	W89-02588 9D
Prediction of Reservoir Phytoplankton Condi-	W89-02534 7C	WATER RESOURCES DATA
tion by the Fluorescence Method, W89-03291 2H	Data on Groundwater Quality for the Ely 1 Degree X 2 Degree Quadrangle, Eastern	Water Resources Activities of the U.S. Geologi- cal Survey in Missouri, Fiscal Year 1987,
WATER QUALITY CONTROL	Nevada, W89-02535 7C	W89-02470 9C
Impacts of Recharge Legislation on Groundwat- er Management in Arizona,		Water Resources of Walworth County, South
W89-02336 4B	Data on Groundwater Quality for the Lund 1 Degree X 2 Degree Quadrangle, Eastern	Dakota, W89-02489 2F
Waste Water Reduction in Metal Fabrications	Nevada, W89-02536 7C	Groundwater Resources of Rusk County, Texas,
Operations, W89-02405 5D		W89-02491 2F
	Water Quality Data (July 1986 Through Sep- tember 1987) and Statistical Summaries (March	Groundwater Resources of Limestone County,
Calpurnia and the Strip Barn, W89-02411 5D	1985 Through September 1987) for the Clark Fork and Selected Tributaries from Deer Lodge	Texas, W89-02583 2F
Nitrogen and Ground Water Protection.	to Missoula, Montana,	WATER RESOURCES DEVELOPMENT
W89-02679 5G	W89-02566 5B	Use of a Regional Ground-Water Flow Model
Ground Water and Agriculture: Addressing the	WATER QUALITY EFFECTS	for Water Rights Administration in a Southwest
Information Needs of Pennsylvania's Chesa- peake Bay Program,	Sewage Hardness and Mortality from Cancer and Cardiovascular Disease,	Alluvial Basin, W89-02332 4B
W89-02680 5G	W89-03309 5D	Impacts of Recharge Legislation on Groundwat-
Organic Chemicals in Natural Waters: Applied	WATER QUALITY FORECASTING	er Management in Arizona,
Monitoring and Impact Assessment, W89-02776 5C	Probability Distribution for Critical DO Loca- tion in Streams.	W89-02336 4B
	W89-03292 7B	Position Paper: Solomon Islands,
Water Quality Problems and Control Strategies for the Water Supply of Tianjin City,	WATER QUALITY MANAGEMENT	W89-02367 2F
W89-02794 5F	Innovative Designs for Water Quality Monitor-	Status of Hydrogeological Mapping in Thailand, W89-02384 2F
Clean Technology in the Netherlands: The Role	ing: Are We Asking the Questions Before the Data Are Collected,	
of the Government, W89-02801 5G	W89-02320 7A	Hydrology versus Water Resources Manage- ment,
Treatment of Filter Effluents from Dewatering	Water Quality Problems and Control Strategies	W89-02724 2A
of Sludges by a New High Performance Flocculation Reactor,	for the Water Supply of Tianjin City, W89-02794 5F	Effects of Steady versus Fluctuating Flows or Aquatic Macroinvertebrates in the Colorado
W89-02819 5D	WATER QUALITY STANDARDS	River below Glen Canyon Dam, Arizona,
Effects of Aeration and Minimum Flow En-	Supplemental Final Development Document for Effluent Limitations Guidelines, New Source	W89-02940 6C
hancement on the Biota of Norris Tailwater, W89-02826 5G	Performance Standards and Pretreatment Stand- ards for the Leather Tanning and Finishing	WATER RESOURCES MANAGEMENT Annual Report, 1986 (Reservoir Control Center
Managing Farm Nutrients: Tradeoffs for Sur-	Point Source Category.	Southwestern Division, U.S. Army Corps of En
face- and Ground-Water Quality, W89-02833 5G	W89-02832 6E	gineer). W89-02716 4A
	Ambient Water Quality Criteria for Chloride -	Conservation Management Options for Rivers
Pesticide and Synthetic Organic Compound Survey: Report to the Iowa General Assembly	1988, W89-02860 5G	W89-02989 6A

WATER RESOURCES REPORTS

VATER RESOURCES REPORTS Bibliography of U.S. Geological Survey Reports	Treatment of Rome Raw Water by Krofta Sand- float Process System Project Documentation	Pretreatment of Drinking Water to Control Or- ganic Contaminants and Taste and Odor,
on the Water Resources of Florida, 1886-1984,	(Part C), W89-02943 5F	W89-02793 5F
W89-02527 10C VATER REUSE	WATER SUPPLY DEVELOPMENT	Water Quality Problems and Control Strategies for the Water Supply of Tianjin City,
Economic And Environmental Impacts of Using	Great American Desert Transformed: Aridity,	W89-02794 5F
Municipal Sewage Effluent for Agricultural Production, W89-02663 5E	Exploitation, and Imperialism in the Making of the Modern American West, W89-02632 6D	Humic Substances Removal by Alum Coagula- tion: Direct Filtration at Low pH,
W89-02663 5E		W89-02795 5F
WATER RIGHTS	Growth and Water in the South Coast Basin of California,	Modeling the Effects of Adsorbed Hydrolyzed
Use of a Regional Ground-Water Flow Model for Water Rights Administration in a Southwest Alluvial Basin,	W89-02636 6D	Al(III)-Ions on Deep Bed Filtration, W89-02796 5F
W89-02332 4B	WATER SUPPLY SYSTEMS Optimizing Operation and Maintenance of	Polyelectrolytes for the Treatment of Tap and
Implications of the Clean Water Act and Safe	Water Supply Wells, W89-02333 6B	Filter Back Washing Water, W89-02797 5F
Drinking Water Act Legislation for Southwest- ern Indian Tribes: Water-Quality Management	Implications of the Clean Water Act and Safe	New Coagulant Injection Process,
and Indian Self Determination, W89-02334 5G	Drinking Water Act Legislation for Southwest-	W89-02798 5F
	ern Indian Tribes: Water-Quality Management and Indian Self Determination,	Odour Control by Artificial Groundwater Re-
Transition from Ground-Water Mining to In- duced Recharge in Generalized Hydrogeologic	W89-02334 5G	charge, W89-02799 5F
Systems, W89-02337 4B	Random Survey of VOC's, Pesticides and Inor- ganics in Arizona's Drinking Water Wells,	Pesticide and Synthetic Organic Compound
Great American Desert Transformed: Aridity,	W89-02344 5A	Survey: Report to the Iowa General Assembly
Exploitation, and Imperialism in the Making of	WATER TABLE	on the Results of the Water System Monitoring Required by House File 2303.
the Modern American West, W89-02632 6D	Development of Groundwater Resources in the	W89-02836 5F
	Orange County Area, Texas and Louisiana, 1980-Spring of 1985,	Using Desalination Technologies for Water
WATER SAMPLING Water Analysis: A Practical Guide to Physico-	W89-02513 2F	Treatment. W89-02849 3A
Chemical, Chemical and Microbiological Water	Groundwater Withdrawals and Changes in	
Examination and Quality Assurance, W89-02777 7B	Groundwater Quality and Land Surface Subsidence in the Houston District, Texas,	Selection Guide for Volatilization Technologies for Water Treatment,
Nonparametric Evaluation of the Size of Limno-	W89-02519 6G	W89-02863 5F
logical Sampling Networks: Application to the Design of a Survey of Green Bay,	Seismic Refraction Tests Above Water Table, W89-03113 7A	Biotreatment Systems: Volume I. W89-02914 5D
W89-03174 7A	WATER TABLE FLUCTUATIONS	Biotreatment Systems: Volume III.
Comparison of In Situ Estimates of Chlorophyll a Obtained with Whatman GF/F and GF/C	Seasonal Changes in Groundwater Levels in the Shallow Aquifers Near Hagerman and the Pecos	W89-02927 5D
Glass-Fiber Filters in Mesotrophic to Hypereu- tophic Lakes,	River, Chaves County, New Mexico, W89-02601 4B	Treatment of Rome Raw Water by Krofta Sand- float Process System - Project Documentation
W89-03217 7B	WATER TEMPERATURE	(Part A), W89-02941 5F
WATER SOFTENING	Karst Water Temperature and the Shaping of	
You and Your Drinking Water: Health Implica- tions for the Use of Cation Exchange Water	Malham Cove, Yorkshire, W89-02737 2F	Treatment of Rome Raw Water by Krofta Sand- float Process System - Project Documentation
Softeners, W89-03060 5F	Temperature Analysis, Howard A. Hanson Res-	(Part B), W89-02942 5F
WATER SUPPLY	ervoir, Washington: Mathematical Model Inves- tigation,	Treatment of Rome Raw Water by Krofta Sand-
Selected Geohydrologic Characteristics of the	W89-02877 2H	float Process System Project Documentation
Patapsco Aquifer at Chalk Point, Prince	WATER TREATMENT	(Part C), W89-02943 5F
Georges County, Maryland, W89-02560 2F	Technologies and Costs for the Treatment of	Treatment of Farnham and Ashlev Reservoir
	Microbial Contaminants in Potable Water Sup- plies.	Water by Krofta Sandfloat Process System -
Computer-Program Documentation of an Inter- active-Accounting Model to Simulate Stream-	W89-02412 5F	Project Documentation, W89-02950 5F
flow, Water Quality, and Water-Supply Oper- ations in a River Basin,	Superfund Record of Decision: Rockaway Bor-	
W89-02600 7C	ough Well Field, NJ. W89-02706 5D	Treatment of Farnham and Ashley Reservoir Water by Krofta Sandfloat Process System
From Filters to Forests: Water Treatment and	Use of Rapid Small-Scale Column Tests to Pre-	Final Project Report, W89-02951 5F
Supply, W89-02792 5F	dict Full-Scale Adsorption Capacity and Per- formance,	Control of Volatile Organic Contaminants in
Water Quality Problems and Control Strategies	W89-02789 5F	Groundwater by In-Well Aeration, W89-02955 5F
for the Water Supply of Tianjin City,	Experiences with Granular Activated Carbon	
W89-02794 5F Treatment of Rome Raw Water by Krofta Sand-	Filtration and On-Site Reactivation at Jefferson Parish, Louisiana,	Evaluation of Sodium Aluminate as a Coagulant for Cost Savings at Water Treatment Plants,
float Process System - Project Documentation	W89-02790 5F	W89-02959 5F
(Part A), W89-02941 5F	Pretreatment in Chemical Water and Wastewater Treatment.	New Disinfection Agents for Water, W89-02970 5F
Treatment of Rome Raw Water by Krofta Sand-	W89-02791 5G	Economic Evaluation of Air Stripping to
float Process System - Project Documentation (Part B).	From Filters to Forests: Water Treatment and	Remove Volatile Organic Compounds from
W89-02942 5F	Supply, W89-02792 5F	Water, W89-02976 5F

Superfund Record of Decision: Vega Alta, PR. W89-02984 5G	Biological Treatment of Groundwater in Basins with Floating Filters: I. Test Arrangements and	Eurasian Snow Cover and Seasonal Forecast of Indian Summer Monsoon Rainfall,
n	General Results,	W89-03054 2B
Problems of the Toxicological Compatibility of Hydrogen Peroxide in Drinking and Swimming	W89-03094 5F	WEATHER MODIFICATION
Pool Water for Humans from the Pharmacokine-	WATER USE	Diagnostic Technique for Targeting during Air-
tic and Biochemical Points of View (Probleme Der Humantoxikologischen Vertraglichkeit von	Pumpage of Water in Louisiana, 1985,	borne Seeding Experiments in Wintertime
Wasserstoffperoxid in Bade- and Trinkwasser	W89-02506 6D	Storms over the Sierra Nevada, W89-03305 2B
aus Biochemischer und Pharmakokinetischer	Water Resources Investigations in Tennessee:	Patent (Parished Patent Patent)
Sicht), W89-03042 5C	Programs and Activities of the U.S. Geological Survey, 1987-1988,	Estimate of Precipitation Enhancement Potential for the Duero Basin of Spain,
	W89-02559 7C	W89-03306 3B
Studies of Permeation of Gases with Disinfect-	Ground Water Consequation Techniques, Poten	SUPATERED DATERNAG
ing Action Across Polymer Barriers, W89-03044 5F	Ground Water Conservation Techniques: Poten- tial Impacts on Water Usage and Quality,	WEATHER PATTERNS Relationships between Snow Cover and Tem-
	W89-02658 3F	perature in the Lower Troposphere, General
Utilization of Biological Methods in Groundwat-	Natural Plans and Water Communication in the	Circulation in East Asia and Precipitation in
er Treatment, W89-03088 5F	Natural Flow and Water Consumption in the Milk River Basin, Montana and Alberta, Canada,	China,
	W89-03004 2E	W89-02609 2C
Treatment of Groundwater with Slow Sand Fil-	Fig. 1. of Fine Count Water Brown as	Cumulus and Thunderstorm Initiation by Moun-
tration, W89-03090 5F	Effects of Future Ground-Water Pumpage on the High Plains Aquifer in Parts of Colorado,	tains,
W 87-03070	Kansas, Nebraska, New Mexico, Oklahoma,	W89-02787 2B
VYREDOX and NITREDOX Methods of In	South Dakota, Texas, and Wyoming,	Eurasian Snow Cover and Seasonal Forecast of
situ Treatment of Groundwater, W89-03091 5F	W89-03031 2F	Indian Summer Monsoon Rainfall,
W 89-03091	WATER UTILIZATION	W89-03054 2B
Modelling of Flow and Transport Processes in	Pumpage of Water in Louisiana, 1985,	WEATHER SATELLITES
Vyredox and Nitredox Subsurface Treatment	W89-02506 6D	Oklahoma-Kansas Mesoscale Convective
Plants, W89-03092 5F	WATER VAPOR	System of 10-11 June 1985: Precipitation Struc-
	Review of 183 GHz Moisture Profile Retrieval	ture and Single-Doppler Radar Analysis,
Biotechnology for Manganese Removal from	Studies,	W89-03273 2B
Groundwater, W89-03093 5F	W89-02705 7C	WEATHERING
	WATER WELL MAINTENANCE	Soil Acidification and Metal Solubility in For-
Biological Treatment of Groundwater in Basins	Optimizing Operation and Maintenance of	ests of Southern Sweden, W89-02308 5B
with Floating Filters: I. Test Arrangements and General Results.	Water Supply Wells,	17 07-02300
W89-03094 5F	W89-02333 6B	Differences in Aluminum Mobilization in Spodo-
Pint of Transport of Complete in Project	WATER WELLS	sols in New Hampshire (USA) and in the Neth- erlands as a Result of Acid Deposition,
Biological Treatment of Groundwater in Basins with Floating Filters: II. The Role of Microor-	Records of Wells and Chemical Analyses of	W89-02309 5B
ganisms in Floating Filters,	Groundwater in Hand and Hyde Counties South Dakota,	
W89-03095 5G	W89-02505 2F	Limits on Cation Leaching of Weakly Podzo- lized Forest Soils: An Empirical Evaluation,
Biological Groundwater Denitrification: Labo-		W89-02310 5B
ratory Studies,	WATER YIELD FORECASTING Hydrologic Design Methodologies for Prefeasi-	
W89-03096 5F	bility Studies of Small-Scale Hydro at Ungauged	Coordination Chemistry at the Solid/Solution Interface,
Problems in Czechoslovakia Regarding Methods	Sites,	W89-02642 5B
of Removal of Nitrates from Drinking Water,	W89-03129 7A	
W89-03098 5D	WATERFOWL	Chemical Weathering of the East Yorkshire Chalk.
Sequestration of Iron in Groundwater by Poly-	Birds,	W89-02731 2K
phosphates,	W89-02772 2L	
W89-03109 5F	WATERTOWN	Phytokarst, Blue-green Algae and Limestone Weathering,
Kinetics of Low Solids Bio-denitrification of	Watertown, Minnesota: Flood Proofing Infor-	W89-02732 2K
Water Supplies,	mation.	
W89-03166 5F	W89-02939 6F	Chemical Erosion in Tower Karst Terrain, Kinta Valley, Peninsular Malaysia,
In Vitro Genotoxicity of Chlorinated Drinking	WAVES	W89-02738 21
Water Processed from Humus-Rich Surface	Numerical Model for the Computation of Radi- ance Distributions in Natural Waters with Wind-	
Water, W89-03202 5C	Roughened Surfaces, Part II: User's Guide and	Limestone Weathering Under a Soil Cover and the Evolution of Limestone Pavements, Malham
W 89-03202	Code Listing,	District, North Yorkshire, UK,
Halamine Water Disinfectants,	W89-02414 2H	W89-02740 21
W89-03285 5F	WEATHER	Hydrology and Solute Uptake in Hillslope Soils
Treatment of Potable Water from Seoul, Korea	Oklahoma-Kansas Mesoscale Convective	
by Flotation, Filtration and Adsorption,	System of 10-11 June 1985: Precipitation Struc-	Project,
W89-03319 5F	ture and Single-Doppler Radar Analysis, W89-03273 2B	W89-02891 20
WATER TREATMENT FACILITIES		Dynamics of Water Chemistry in Hardwood and
From Filters to Forests: Water Treatment and	Relationship of Surface Pressure Features to the	
Supply, W89-02792 5F	Precipitation and Airflow Structure of an In- tense Midlatitude Squall Line,	W89-02900 28
	W89-03274 2B	Some Implications of Small Catchment Solut
Pesticide and Synthetic Organic Compound	WEATHER FORECASTING	Studies for Geomorphological Research,
Survey: Report to the Iowa General Assembly on the Results of the Water System Monitoring	WEATHER FORECASTING Snow Cover, Cyclogenesis and Cyclone Trajec-	W89-02902 21
Required by House File 2303.	tories,	Patterns of Hillslope Solutional Denudation is
W00 02026 SE	W90 02607	Relation to the Spatial Distribution of Soil Mois

WEATHERING

ture and Soil Chemistry over a Hillslope Hollow	Assimilative Capabilities of Retention Ponds,	Hydrology of Area 59, Northern Great Plains
and Spur, W89-02906 2J	W89-02856 5D	and Rocky Mountain Coal Provinces, Colorado and Wyoming,
WEIRS	Causes of Wetland Loss in the Coastal Central Gulf of Mexico. Volume 2: Technical Narrative.	W89-02501 2E
Vibration and Leakage of Weir Gates,	W89-02878 4C	Evapotranspiration Rates at Selected Sites in the
W89-03073 8C		Powder River Basin, Wyoming and Montana,
WELL DATA	Gulf of Mexico. Volume 3. Appendices.	W89-02524 2D
Records of Wells and Chemical Analyses of Groundwater in Hand and Hyde Counties South	W89-02879 4C	Groundwater Levels in Wyoming, 1976 Through 1985,
Dakota, W89-02505 2F	Hydrology and Chemistry of Selected Prairie	W89-02525 7C
Elected Hydrologic Data for Pahvant Valley	man County, North Dakota, 1979-82,	Hydrology of the White Tail Butte Area, North-
and Adjacent Areas, Millard County, Utah,		ern Campbell County, Wyoming, W89-02596 4C
1987, W89-02569 7C		Summary of the High Plains Regional Aquifer-
Selected Groundwater Information for the Co-	W89-03123 2H	System Analysis in Parts of Colorado, Kansas,
lumbia Plateau Regional Aquifer System, Washington and Oregon, 1982-1985: Volume I, Geo-	Responses of Four Irish Wetland Tree Species	Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming,
hydrology,	to Raised Soil Water Levels, W89-03128 2H	W89-03030 2F
W89-02572 7C		Effects of Future Ground-Water Pumpage on
Selected Groundwater Information for the Co	Fluxes Between the Alluvial Aquifer and Sur-	the High Plains Aquifer in Parts of Colorado,
lumbia Plateau Regional Aquifer System, Wash	the control of the co	Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming,
ington and Oregon, 1982-1985: Volume II Water Levels,	W89-03140 6G	W89-03031 2F
W89-02573 7C		Regional Aquifer System Underlying the North-
WELL LOGS	Water Environments, W89-03265 2H	ern Great Plains in Parts of Montana, North
Improved Fresh Water Assessment in Sand		Dakota, South Dakota, and Wyoming: Summa-
Aquifers Utilizing Geophysical Well Logs, W89-02347 2F	Effect of Climate on Development of Two	ry, W89-03033 2F
	Sphagnum Bogs in South-Central Wisconsin, W89-03293 2H	
WELL PACKERS		XAD-4 RESIN
Use of Well Packers To Control TCE and PCE Contaminants,	Fertility and Disturbance Gradients: A Summa- ry Model for Riverine Marsh Vegetation,	Application of XAD-4 Solid Sorbent and HPLC with Electrochemical Detection to the Analysis
W89-02356 5G		of Phenols in Water,
WELL SCREENS	Hydrochory and Regeneration in a Bald Cy-	W89-02420 5A
Rationale for the Design of Monitoring Wel		XANTHATES
Screens and Filter Packs, W89-03332 5E	W89-03295 2H	Fate and Effects of Xanthates in Laboratory
	WHEAT	Freshwater Systems, W89-03201 5G
WELLS Optimizing Operation and Maintenance o	Saline Seep on Wheatland in Northwest Oklaho-	
Water Supply Wells,	ma, W89-02672 5B	YAMPA RIVER Calibration of a Dissolved-Solids Model for the
W89-02333 6H		Yampa River Basin Between Steamboat Springs
National Survey of Pesticides in Drinking Water	WIND Numerical Model for the Computation of Radi-	and Maybell, Northwestern Colorado,
Wells,	ance Distributions in Natural Waters with Wind-	W89-02591 5B
W89-02656 5E	Roughened Surfaces, Part II. Oser's Guide and	YELLOW PERCH
Control of Volatile Organic Contaminants in	Code Listing, W89-02414 2H	Biology of the Yellow Perch in Lake Sharpe, South Dakota, 1964-1975,
Groundwater by In-Well Aeration, W89-02955		W89-02428 2H
	Diagnostic Technique for Targeting during Air- borne Seeding Experiments in Wintertime	VORKSHIRE
WEST GERMANY Project Appraisal, Resource Allocation and	Storms over the Sierra Nevada,	YORKSHIRE Chemical Weathering of the East Yorkshire
Public Involvement,	W89-03305 2B	Chalk,
W89-02758 6B	WISCONSIN	W89-02731 2K
WEST VIRGINIA	Estimating Magnitude and Frequency of Floods for Wisconsin Urban Streams,	Stable Isotopes: An Investigation into Their Ap-
Hydrology of Area 8, Eastern Coal Province West Virginia and Ohio,	W89-03003 2E	plication in Karst Hydrology in the U.K., with Special Reference to the Malham Area, North
W89-02598 46	Effect of Climate on Development of Two	Yorkshire,
WESTERN UNITED STATES	Sphagnum Bogs in South-Central Wisconsin,	W89-02734 2F
Water and Arid Lands of the Western United	W89-03293 2H	YORKSHIRE DALES
States. W89-02630 61	WITHDRAWAL	Valley Excavation in the Yorkshire Dales Karst,
	Pumpage of Water in Louisiana, 1985,	W89-02742 2F
New Water Policies for the West, W89-02639	W89-02506 6D	YUGOSLAVIA
	Development of Groundwater Resources in the	Identification of a Karst Hydrological System in
WETLANDS Effects of Atmospheric Pollutants on Forest	Orange County Area, Texas and Louisiana, 1980-Spring of 1985,	the Dinaric Karst (Yugoslavia), W89-03052 2F
Wetlands and Agricultural Ecosystems.	W89-02513 2F	
W89-02304 5		ZIMBABWE Schistosomiasis Control in Irrigation Schemes in
Natural and Anthropogenic Acidification of		Zimbabwe,
Peatlands,	Through September 1987,	W89-03066 5G
W89-02311 5	B W89-02468 4B	ZINC
Responses to Acidic Deposition in Ombotroph		Effects of Heavy Metal Pollution on Epilithic
Mires in the U.K., W89-02314 5	Water Research Center), B W89-02479 9D	Bacteria, W89-02552 50

ZOOPLANKTON

Growth, Fecundity, and Energy Stores of White Sucker (Catostomus commersoni) from Lakes Containing Elevated Levels of Copper and Zinc, W89-03225

ZOOPLANKTON
Zooplankton Biomass Exchange in Lake Sharpe,
South Dakota, 1974-1975,
W89-02425
2H

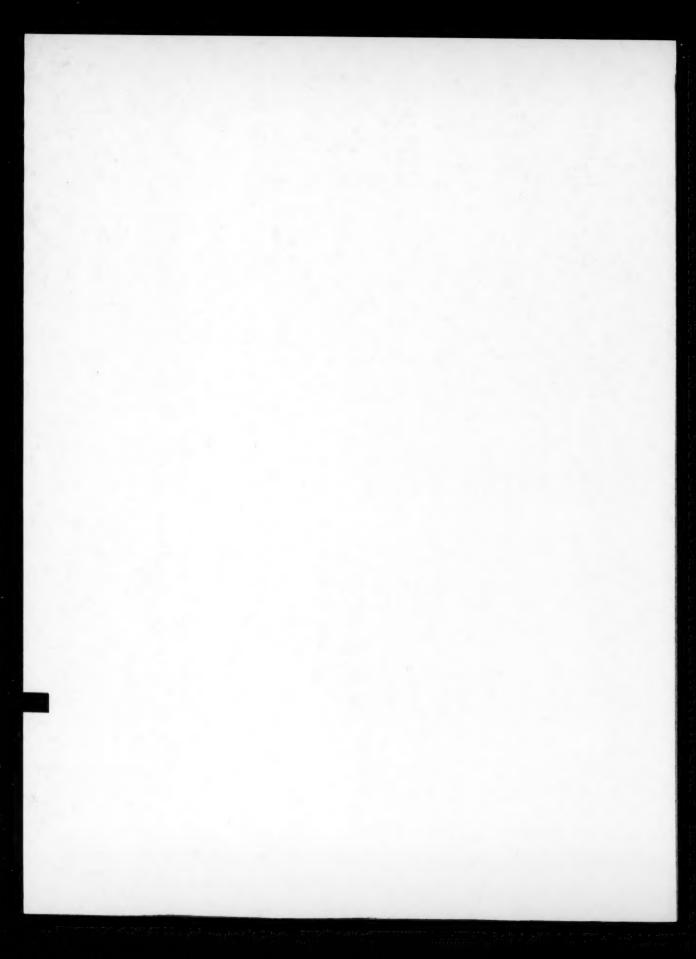
Plankton, W89-02770

2L

Effects of the Blue-Green Alga Microcystis Aeruginosa on Zooplankton Competitive Relations, W89-03118 2H

Ecological Principles Affecting Community Structure and Secondary Production by Zoo-

plankton in Marine and Freshwater Environ-ments, W89-03267 2H



AUTHOR INDEX

AAMAND, J.	ALGER, R. P.	ANDERHOLM, S. K.
Potential of Free-Living Ground Water Bacteria	Improved Fresh Water Assessment in Sand	Description of Piezometer Nests and Water
to Degrade Aromatic Hydrocarbons and Heter- ocyclic Compounds,	Aquifers Utilizing Geophysical Well Logs, W89-02347 2F	Levels in the Rio Grande Valley Near Albu- querque, Bernalillo County, New Mexico,
W89-03086 5B		W89-02509 2F
	ALI, A.	
ABELIOVICH, A. Biological Groundwater Denitrification: Labo-	Diflubenzuron Application to Citrus and Its Impact on Invertebrates in an Adjacent Pond,	ANDERSON, E. W. Relationship Between Soil Creep Rate and Cer-
ratory Studies,	W89-03208 5C	tain Controlling Variables in a Catchment in
W89-03096 5F	ALI, S. R.	Upper Weardale, Northern England,
ABRAHAMSEN, G.	PakistanStatus Report,	W89-02905 2J
Air Pollution and Soil Acidification,	W89-02381 4B	ANDERSON, G. K.
W89-02306 5B	ALLA, P.	Fate of COD in an Anaerobic System Treating
ACKERMAN, D. J.	Vulnerability Study of the Aubergenville Aqui-	High Sulphate Bearing Wastewater,
Generalized Potentiometric Surface of the	fer,	W89-02295 5D
Sparta-Memphis Aquifer, Eastern Arkansas,	W89-03077 5B	ANDERSON, J. E.
Spring 1980, W89-02575 7C	ALLAN, R. J.	Hydrologic Design Methodologies for Prefeasi-
W89-02575 7C	Utility of Soluble Reactive Phosphorus Meas-	bility Studies of Small-Scale Hydro at Ungauged
ACKERS, P.	urements in Great Lakes Surveillance Programs: A Summary,	Sites, W89-03129 7A
Reservoir Sedimentation and Influence of Flush-	W89-03180 5A	
ing, W89-02457 2J		ANDERSON, M. G.
	ALLEMAN, J. E. Respiration-Based Evaluation of Nitrification In-	Controls on Overland Flow Generation, W89-02882 2E
ADOMAITIS, V. A.	hibition Heing Enriched Nitrosomones Cultures	W 69-02002
Hydrology and Chemistry of Selected Prairie Wetlands in the Cottonwood Lake Area, Stuts-	W89-02302 7B	Flood Inundation Modelling Using MILHY,
man County, North Dakota, 1979-82,	ALLETSON, D. J.	W89-03330 2E
W89-03035 2H	River Response to Catchment Conditions,	Modelling Seasonally Freezing Ground Condi-
AFFONSO, A.	W89-02990 2H	tions,
Studies of Permeation of Gases with Disinfect	ALLSOPP, T. R.	W89-03331 2C
ing Action Across Polymer Barriers,	Potential Impacts of a Scenario of CO2-Induced	ANDERSON, R. T.
W89-03044 5F	Climatic Change on Ontario, Canada,	Data on the Distribution and Abundance of Sub-
AFOUDA, A.	W89-03063 2A	mersed Aquatic Vegetation in the Tidal Poto-
Mathematical Modelling,	ALMON, E.	mac River and Estuary, Maryland, Virginia, and
W89-02725 2A	Contaminated Aquifers are a Forgotten Compo-	the District of Columbia, 1986, W89-02511 7C
AGNEW, J. D.	nent of the Global N2O Budget,	
Monitoring and Surveillance,	W89-03121 5B	ANDERSSON, P.
W89-02991 7E	ALTMAYER, F.	Effects of Liming on the Distribution of Cadmi- um in Water, Sediment, and Organisms in a
AHLERT, R. C.	Performance of Analytical Test Kits on Metal	Swedish Lake,
Pilot Plant Demonstration of In-situ Biodegrada	Finishing Wastewater Samples, W89-02403 5D	W89-03224 5E
tion of 1,1,1-Trichloroethane,	110702100	ANDERSON T
W89-03164 5E		ANDERSSON, T. Physiological Disturbances in Fish Living in
AHRENS, W. A.	Investigations on Leaching of Dicyandiamide and its Decomposition in Flooded Soils (Unter-	Coastal Water Polluted with Bleached Kraf
Water Resources of the Upper Colorado Rive	suchungen zur Auswaschung von Dicyandiamid	Pulp Mill Effluents,
Basin: Problems and Policy Alternatives,	und Dessen Abbau in Uberstauten Boden),	W89-03234 50
W89-02635 6I	W89-03043 5B	ANDREWS, E. D.
AHRING, B. K.	AMBROISE, B.	Emerging Issues in Surface Water Quality Re
Toxicity of Heavy Metals to Thermophilic An	afairm . armount, or acce any array	search,
aerobic Digestion, W89-02922 51	erties in the Petite Fecht Catchment, Soultzeren,	W89-02721 50
W 85-02522	France - Preliminary Results, W89-02883 2G	Formation of a Coarse Surface Layer as the
AINSWORTH, C. C.		Response to Gravel Mobility,
Influence of Cosolvents on Quinoline Sorptio		W89-02440 2
by Subsurface Materials and Clays, W89-03040 5	Spatial Variability of Soil Hydrodynamic Prop- erties in the Petite Fecht Catchment, Soultzeren,	ANG, N. K.
	France - Preliminary Results,	Status of Hydrogeological Mapping in Peninsu
AKRIDGE, J. D.	W89-02883 2G	lar Malaysia, W89-02377 21
Two Test Procedures for Radon in Drinkin Water: Interlaboratory Collaborative Study,	AMUNDSON, F. D.	W 89-02377
W89-02956 54		AOKI, T.
AT A PARTETABLE OF	Eastern South Dakota,	Continuous Flow Determination of Carbon D
ALA-PEIJARI, T. Aquifer Thermal Energy Storage in Finland	W89-02515 7C	oxide in Water by Membrane Separation-Chemi luminescent Detection,
W89-03082 4		W89-03182 7
	Effects of Ozone and Acid Rain on White Pine	
ALEXANDER, C. M. Effects of Aeration and Minimum Flow E	(Pinus strobus) Seedlings Grown in Five Soils:	APONASENKO, A. D. Prediction of Reservoir Phytoplankton Cond
hancement on the Biota of Norris Tailwate		tion by the Fluorescence Method,
W89-02826 5	3	W89-03291 2
ALEXANDER, M.	AMUNDSON, R. G.	APPLEBY, P. G.
Role of Protozoa in Microbial Acclimation for	Effects of Ozone and Acid Rain on White Pine (Pinus strobus) Seedlings Grown in Five Soils:	Recent Acidification of a Large Scottish Loc
Mineralization of Organic Chemicals in Sewag		Located Partly within a National Nature R
W89-03283	D W89-03057 5C	serve and Site of Special Scientific Interest,
ALFOLDI, L.	ANDERHOLM, S.	W89-03125 5
Groundwater Microbiology: Problems and Bi		APPLETON, C. C.
logical Treatment: State-of-the-Art Report,	Basins, Socorro County, New Mexico,	Uses of, and Human Impact on Rivers,

ARCEMENT, G. J.

ARCEMENT, G. J.	ATTEBERY, C. W.	for Sunflower AAP NQ Wastewater Treatment
Roughness Coefficients for Densely Vegetated	Wastewater Characterization and Hazardous	Facility,
Flood Plains, W89-02502 2E	Waste Survey, Castle AFB, CA,	W89-02828 5D
	W89-02704 5D	BALDWIN, T. E.
ARES, J.	AUDET, C.	Northern Hemisphere Snow and Ice Chart of
Interactions of Organic Matter and Aluminum Ions in Acid Forest Soil Solutions: Metal Com-	Long-Term Sublethal Acid Exposure in Rain- bow Trout (Salmo gairdneri) in Soft Water:	NOAA/NESDIS,
plexation, Flocculation, and Precipitation,	Effects on Ion Exchanges and Blood Chemistry,	W89-02616 2C
W89-03126 2K	W89-03226 5C	BALL, R. O.
ARIENTI, M.	AULENBACH, D. B.	Economic Evaluation of Air Stripping to
Corrective Measures for Releases to Ground-	BOD and Nutrient Removal by Biological A/O	Remove Volatile Organic Compounds from
water from Solid Waste Management Units, W89-02844 5G	Process Systems,	Water, W89-02976 5F
	W89-03326 5D	W 89-02976
ARISS, C. W.	BABLON, G.	BALLEAU, W. P.
National Surface Water Survey: National Stream Survey Phase I - Pilot Survey,	New Coagulant Injection Process,	Transition from Ground-Water Mining to In-
W89-02842 5G	W89-02798 5F	duced Recharge in Generalized Hydrogeologic Systems,
ARMSTRONG, A. C.	BACHOFNER, P.	W89-02337 4B
Hydrology and Water Quality of a Drained Clay	New Lebring Scheme Replaces the Oldest Plant	DATE AND D
Catchment, Lockle Park, Northumberland,	on the Mur, W89-03153 8C	BALTEANU, D. Sources of Sediment and Channel Changes in
W89-02889 2E		Small Catchments of Romania's Hilly Regions
ARMSTRONG, D. E.	BADGER, D. D.	W89-02896 2J
Horizontal and Vertical Distribution of PCBs in	Economic And Environmental Impacts of Using Municipal Sewage Effluent for Agricultural	BALTHROD B II
Southern Lake Michigan Sediments and the Effect of Waukegan Harbor as a Point Source,	Production,	BALTHROP, B. H. Water Resources Investigations in Tennessee
W89-03170 5B	W89-02663 5E	Programs and Activities of the U.S. Geological
ARMSTRONG, J. M.	BAIASCO, A. A.	Survey, 1987-1988,
Biodegradation Modeling at Aviation Fuel Spill	Engineering/Cost Evaluation of Options for Re-	W89-02559 7C
Site,	moval/Disposal of NC Fines,	Water Resources Investigations in Tennessee
W89-03100 5G	W89-02933 5D	Programs and Activities of the U.S. Geologica
ARNELL, N. W.	BAILEY, D.	Survey, 1987-1988,
Flood Insurance and Floodplain Management,	Electrolytic Recovery Theory, Application, Ad-	W89-02570 90
W89-02750 6F	vantages,	BANTA, R.
ARNUP, K. R.	W89-02407 5D	Cumulus and Thunderstorm Initiation by Moun
Effects of Temperature, Salinity and Seagrass Species on the Uptake of Lead(II) from Sea-	BAIN, M. B.	tains,
water by Excised Leaves.	Cumulative Impact Assessment: Application of a	W89-02787 2E
W89-03275 5B	Methodology, W89-02824 7C	BANTON, O.
ARRUDA, J. A.		Sensitivity Analysis of Adsorption and Degrada
Pesticides in Fish Tissue and Water from Tuttle	Cumulative Impact Assessment: Issues to Con-	tion Parameters in the Modeling of Pesticide
Creek Lake, Kansas,	sider in Selecting a Cumulative Assessment Method,	Transport in Soils,
W89-03317 5B	W89-02965 5C	W89-03150 2C
ARVIN, E.	BAKER, B. P.	BARBASH, J. E.
Biodegradation of Nitrogen- and Oxygen-Con- taining Aromatic Compounds in Groundwater	Incentives and Institutions to Reduce Pesticide	Groundwater Contamination at a Landfill Site
from an Oil-Contaminated Aquifer,	Contamination of Ground Water,	on Fractured Carbonate and Shale, W89-03146 51
W89-03149 5B	W89-02677 5G	W89-03146 51
Potential of Free-Living Ground Water Bacteria	BAKER, E. G.	BARCELO, E.
to Degrade Aromatic Hydrocarbons and Heter-	Water Resources Investigations in Tennessee:	Effects of Hydroelectric Scheme on Fluvia
ocyclic Compounds,	Programs and Activities of the U.S. Geological	Ecosystems within the Spanish Pyrenees, W89-03138 60
W89-03086 5B	Survey, 1987-1988, W89-02559 7C	W 67-03136
ASANO, T.		BARIAC, J.
Pretreatment for Wastewater Reclamation and	Water Resources Investigations in Tennessee:	Utility of Soluble Reactive Phosphorus Meas
Reuse, W89-02820 5D	Programs and Activities of the U.S. Geological Survey, 1987-1988,	urements in Great Lakes Surveillance Programs A Summary,
	W89-02570 9C	W89-03180 5/
ASHIDA, K. Mountain Torrent Erosion,	W. B. BIE C. CA HG C	
W89-02447 2J	Water Resources Publications of the U.S. Geo- logical Survey, For Tennessee, 1906-1987,	BARKER, D. J. P. Appendicitis Epidemic Following Introductio
ASKEW, A.	W89-02467 10C	of Piped Water to Anglesey,
Hydrology and Data Acquisition,	DAVED I M	W89-03041 5
W89-02726 2A	BAKER, J. M. Intertidal Rock,	DADVED I E
ATKINSON, D. S.	W89-02767 2L	BARKER, J. F. Groundwater Contamination at a Landfill Site
Microtox Assessment of Anaerobic Bacterial	DAVED D	on Fractured Carbonate and Shale,
Toxicity,	BAKER, R. National Surface Water Survey: National	W89-03146 5
W89-02301 5D	Stream Survey Phase I - Pilot Survey,	BARKER I M
ATKINSON, L. P.	W89-02842 5G	BARKER, J. M. Planning Biological Surveys,
SPREX Hydrographic Data Report, Volume 3 - Chlorophyll and Nutrients,	BAKER, R. J.	W89-02760 7
W89-03323 2L		
	ganic Contaminants and Taste and Odor,	BARKO, J. W.
ATKINSON, S. F. Ground Water Contamination from Saltwater	W89-02793 5F	Contrasting Diel Patterns of Vertical Migratic in the Dinoflagellate Ceratium hirundinella
Intrusion And Limitations on Agricultural Ac-		Relation to Phosphorus Supply in a North Ter
tivities,	Economic Evaluation of Carbon Adsorption/	perate Reservoir,
W89-02662 5B	Ion Exchange Wastewater Treatment Options	W89-03221 2

2H

BARNELA, S. B. New Disinfection Agents for Water, W89-02970 5F	BEDARD, J. Above- and Below-Ground Macrophyte Production in Scirpus Tidal Marshes of the St.	BERGKVIST, B. Soil Acidification and Metal Solubility in Forests of Southern Sweden,
BARNES, C. A. Puget Sound: A Fjord System Homogenized	Lawrence Estuary, Quebec, W89-03055 2L	W89-02308 5B
with Water Recycled over Sills by Tidal Mixing, W89-02694 2L	BEDFORD, W. K. Fate of 4,6-Dinitro-o-Cresol in Municipal Activated Sludge Systems,	BERGMAN, H. L. Effects of Low pH and Aluminum on Ventila- tion in the Brook Trout (Salvelinus fontinalis),
BARNES, R. S. K. Coastal Lagoons of East Anglia, U.K.,	W89-02296 5D	W89-03240 5C
W89-03184 2L BARRY, R. G.	BEDIENT, P. B. Biodegradation Modeling at Aviation Fuel Spill	Fiscal Year 1986 Program Report (Wyoming Water Research Center), W89-02479 9D
Snow Cover Data: Status and Future Prospects, W89-02618 7B	Site, W89-03100 5G	Morphometric Changes in Gill Secondary La-
BARTEAUX, W. L. Evaluation of Baseline Conditions at Lease	BEHRENS, U. Aerobic Treatment of Sewage from Lignite (Brown Coal) Processing,	mellae of Brook Trout (Salvelinus fontinalis) after Long-Term Exposure to Acid and Alumi- num.
Tract C-a, Rio Blanco County, Colorado, W89-02974 5B	W89-02915 5D BELKIN, S.	W89-03243 5C
BASMADJIAN, J. Change in Sedimentation Following River Diversion in the Eastmain Estuary (James Bay), Canada.	Biological Groundwater Denitrification: Laboratory Studies, W89-03096 5F	Physiological Evidence of Acclimation to Acid/ Aluminum Stress in Adult Brook Trout (Salve- linus fontinalis): II. Blood Parameters by Cannu- lation,
W89-03186 2J	BELLER, H. R. Hexachlorophene Distributions in Estuarine	W89-03238 5C
BATH, A. J. Research and Information Needs,	Sediments, W89-03196 5B	BERGMAN, W. A. Tunnel and Reservoir Plan Solution to Chica-
W89-02993 2H	BEN-MOSHE, M.	go's Combined Sewer Overflow, Basement Flooding, and Pollution,
BATHURST, J. C. Bed Load Discharge Equations for Steep Moun-	Effect of Activated Sludge in the Breeder Diet on the Reproduction Criteria and the Perform-	W89-03134 4A
tain Rivers, W89-02445 2J	ance of their Offspring, W89-03061 5E	BESCHTA, R. L. Conceptual Models of Sediment Transport in
BATTARBEE, R. W.	BENCE, J. R.	Streams,
Recent Acidification of a Large Scottish Loch Located Partly within a National Nature Re- serve and Site of Special Scientific Interest,	Indirect Effects and Biological Control of Mos- quitoes by Mosquitofish, W89-03124 2H	W89-02443 23 BEST, H. J.
W89-03125 5C	BENDER, J. H.	River Conservation - Implications for Legisla- tion,
BAUCH, L. Chemical Treatment of Flue Gas Washing Liq-	Municipal Wastewater Treatment Technology Transfer Activities of the United States Environ-	W89-02992 6E
uids, W89-02809 5D	mental Protection Agency, W89-03325 5D	BESTOW, T. T. Organization of Hydrogeological Mapping Pro
BAUSCH, W. C.	BENEKE, T. W.	grams, W89-02388
Evapotranspiration of Native Vegetation in the Closed Basin of the San Luis Valley, Colorado, W89-02481 2D	Impairment of Mobility and Development in Freshwater Snails (Physa fontinalis and Lymnaea stagnalis) Caused By Herbicides, W89-03290 5C	BETTESS, R. Extremal Hypotheses Applied to River Regime
BAYLEY, P. B. Accounting for Effort When Comparing Tropi-	BENOIT, D.	W89-02454 2
cal Fisheries in Lakes, River-Floodplains, and Lagoons,	Ambient Water Quality Criteria for Chloride - 1988, W89-02860 5G	BEVER, C. Pesticides in Fish Tissue and Water from Tuttle Creek Lake, Kansas,
W89-03269 2H	BENOIT. G.	W89-03317 5i
BAYLEY, S. W. Sources of Alkalinity in Precambrian Shield Wa- tersheds Under Natural Conditions and After	Biogeochemistry of Lead-210 and Polonium-210 in Fresh Waters and Sediments, W89-02555 2K	BHANU KUMAR, O. S. R. U. Eurasian Snow Cover and Seasonal Forecast of Indian Summer Monsoon Rainfall,
Fire or Acidification, W89-02313 2G	BENSON, R. D.	W89-03054 21
BAZZA, R. V.	Drainage Areas in the James River Basin in Eastern South Dakota,	BHAVE, P. R. Extended Period Simulation of Water Systems
Metal Finishing Wastewater Treatment Upgrade with an Insoluble Sulfide Precipitation Process, W89-02402 5D	W89-02515 7C	Direct Solution, W89-03106
BECKMAN, B. R.	BERG, W. A. Nitrogen and Ground Water Protection.	DIFFRAN V I
Copper Intoxication in Chinook Salmon (Incor- hynchus Tshawystscha) Induced by Natural	W89-02679 5G Saline Seep on Wheatland in Northwest Oklaho-	Development of Estimation Methods for Tributary Loading Rates of Toxic Chemicals,
Springwater: Effects on Gill Na(+), K(+)- ATPase, and Plasma Glucose,	ma, W89-02672 5B	W89-02547 5
W89-03228 5C	BERGER, D. L.	BIEZUGBE, G. Evaluation of Baseline Conditions at Least
BECKMAN, L. G. Biology of the Walleye in Lake Sharpe, South Dakota, 1964-1975,	Geophysical Logs and Hydrological Data for Eight Wells in the Coyote Spring Valley Area, Clark and Lincoln Counties, Nevada,	Tract C-a, Rio Blanco County, Colorado,
W89-02427 2H	W89-02603 4B	Diconium 1, in in
Limnological and Fishery Studies on Lake Sharpe, a Main-stem Missouri River Reservoir,	SPREX Hydrographic Data Report, Volume 3	Oklahoma-Kansas Mesoscale Convective System of 10-11 June 1985: Precipitation Structure and Single-Doppler Radar Analysis,
1964-1975, W89-02423 2H	Chlorophyll and Nutrients, W89-03323 2L	THOO 02272
Relative Abundance and Distribution of Young		BILLI, P.
of-the-Year Fishes and Minnows in Lake Sharpe, South Dakota, W89-02426 2H	ests of Southern Sweden,	Vortex-tube Trap on Virginio Creek, Italy,

BINGHAM, R. H.

BINGHAM, R. H. Regionalization of Winter Low-flow Characteristics of Tennessee Streams,	BOLSENGA, S. J. Operations for an Under-Ice Ecology Program, W89-03179 2H	BOROFKA, B. P. Developing a State Ground Water Policy in the Corn Belt: the Iowa Case,
W89-03005 2E	BOLSUNOVSKII, A. Y.	W89-02681 2F
BINOYI, R. D. Wastewater Characterization and Hazardous	Prediction of Reservoir Phytoplankton Condition by the Fluorescence Method,	BOSCH, J. M. River Response to Catchment Conditions,
Waste Survey, Castle AFB, CA,	W89-03291 2H	W89-02990 2H
W89-02704 5D	BOLTON, P.	BOSSONG, C. R.
BISOGNI, J. J. Fate of Added Alkalinity During Neutralization of Acid Lake,	Schistosomiasis Control in Irrigation Schemes in Zimbabwe, W89-03066 5G	Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama,
W89-03111 5G	BONACCI, O.	Area 1, W89-02578 5B
BLACK, K.	Identification of a Karst Hydrological System in the Dinaric Karst (Yugoslavia),	BOSTICK, K.
Field Simulation of Waste Impoundment Seep- age in the Vadose Zone,	W89-03052 2F	Hydrogeologic and Geochemical Aspects of
W89-02348 5B	BOND, A. M.	Contaminant Transport at the Falls City, Texas UMTRA Site,
BLAKEY, N. C.	Effects of Temperature, Salinity and Seagrass Species on the Uptake of Lead(II) from Sea-	W89-02362 5B
Effect of Unsaturated/Saturated Zone Property Upon the Hydrogeochemical and Microbiologi- cal Processes Involved in the Migration and	water by Excised Leaves, W89-03275 5B	BOSWORTH, D. Controls on Overland Flow Generation,
Attenuation of Landfill Leachate Components,	BOND, J. J.	W89-02882 2E
W89-03087 5B	Stringfellow Leachate Treatment with RBC, W89-03328	BOTTS, J. A.
BLANTON, J. O.		Patapsco Wastewater Treatment Plant Toxicity
Nearshore Transport Processes Affecting the Dilution and Fate of Energy-Related Contami-	BONN, G. Analysis of Volatile Halogenated Hydrocarbons	Reduction Evaluation, W89-02300 5D
nants, W89-02843 5B	on the ppq Scale, W89-03301 5A	BOURBONNIERE, R. A.
Nearshore Transport Processes Affecting the	BONNET, C. W.	Sediment Record of Biogeochemical Responses
Dilution and Fate of Energy-Related Contami-	Development of Groundwater Resources in the	to Anthropogenic Perturbations of Nutrient Cycles in Lake Ontario.
nants, W89-02972 5B	Orange County Area, Texas and Louisiana, 1980-Spring of 1985,	W89-03222 2H
BLEE, J. W. H.	W89-02513 2F	BOUWMAN, L. A.
Determination of Evaporation and Seepage	Records of Wells, Drillers' Logs, Water Level	Meiofauna,
Losses, Upper Lake Mary near Flagstaff, Arizo-	Measurements, and Chemical Analyses of	W89-02766 2L
na, W89-02558 2H	Groundwater in Harris and Galveston Counties, Texas 1980-84.	BOWMAN, M. J.
BLINN, D. W.	W89-02497 7C	Estuarine Fronts, W89-02689 2L
Effects of Steady versus Fluctuating Flows on	BONNET, G.	BOYER, J. D.
Aquatic Macroinvertebrates in the Colorado River below Glen Canyon Dam, Arizona,	Seismic Refraction Tests Above Water Table, W89-03113 7A	Pilot Plant Demonstration of In-situ Biodegrada-
W89-02940 6G	BONNET, P.	tion of 1,1,1-Trichloroethane, W89-03164 5D
BLODGETT, J. C.	Load-Sharing Linings: A New Design Concept for Large Diameter Penstocks,	BRADLEY, J. B.
Magnitude and Frequency of Debris Flows, and Areas of Hazard on Mount Shasta, Northern	W89-03158 8F	Influence of Large Suspended-Sediment Con-
California, W89-03029 2J	BOORMAN, L. A.	centrations in Rivers, W89-02451 2J
	Design of Reinforced Grass Waterways, W89-02859 8A	
BOARI, G. Influence of Na and Ca Alkalinity on UASB	BOOTH, C. E.	BRADLEY, M. W. Construction, Geologic, and Hydrologic Data
Treatment of Olive Mill Effluents: I. Preliminary	Effects of Aluminum and Low pH on Net Ion	for Observation Wells in the Reelfoot Lake
Results, W89-03116 5D	Fluxes and Ion Balance in the Brook Trout (Salvelinus fontinalis),	Area, Tennessee and Kentucky, W89-02510 7B
BODAR, C. W. M.	W89-03235 5C	
Effects of Cadmium Exposure on Feeding of	Physiological Evidence of Acclimation to Acid/	BRADNER, L. A. Potentiometric Surface of the Upper Floridan
Freshwater Planktonic Crustaceans, W89-03288 5C	Aluminum Stress in Adult Brook Trout (Salve- linus fontinalis): I. Blood Composition and Net	Aquifer in the St. Johns River Water Manage- ment District and Vicinity, Florida, September
Effects of Cadmium on Consumption, Assimila- tion and Biochemical Parameters of Daphnia	Sodium Fluxes, W89-03237 5C	1987, W89-02503 7C
magna: Possible Implications for Reproduction,	BOOTH, S.	BRAESTER, C.
W89-03289 5C	Position Paper: Solomon Islands, W89-02367 2F	Modelling of Flow and Transport Processes in
BOERNER, R. E. J. Role of the Seed Bank in the Development of		Vyredox and Nitredox Subsurface Treatment Plants,
Vegetation on a Freshwater Marsh Created	BORCHERS, H. J. Control of Volatile Organic Contaminants in	W89-03092 5F
from Dredge Spoil, W89-03169 2H	Groundwater by In-Well Aeration, W89-02955 5F	VYREDOX and NITREDOX Methods of In situ Treatment of Groundwater,
BOLDT, D.	BOREN, H.	W89-03091 5F
Projections of Water Availability in the Lower Rio Grande, Gila-San Francisco and Mimbres	Odour Control by Artificial Groundwater Re-	BRAMLEY, M. E.
Drainage Basins to 2005, W89-02474 6D	W89-02799 5F	D : CD : C . C . W.
	BORG, H.	
BOLLER, M. Alternative Treatment of De-Icing Fluids from	Effects of Liming on the Distribution of Cadmi- um in Water, Sediment, and Organisms in a	
Airports,	Swedish Lake,	Reduction Evaluation,
W89-02807 5D	W89-03224 5B	W89-02300 5D

BREDTHAUER, S. R. Design Problems in Gravel-Bed Rivers, Alaska, W89-02458 2J	BRYAN, R. B. Runoff and Sediment Transport Dynamics in Canadian Badland Micro-Catchments,	flow, Water Quality, and Water-Supply Oper- ations in a River Basin, W89-02600 7C
BRENNER, R. C. Pilot-Plant Evaluations of Porous Biomass Sup-	W89-02887 2E BRYSON, H. C.	BURT, T. P.
ports, W89-03104 5D	Hydrogeologic and Geochemical Aspects of Contaminant Transport at the Falls City, Texas	Catchment Experiments in Fluvial Geomorpho- logy: A Review of Objectives and Methodolo-
BRINSON, M. M.	UMTRA Site, W89-02362 5B	gy, W89-02881 2E
Forested Wetlands in Freshwater and Salt- Water Environments, W89-03265 2H	BRZEZINSKA-PAUDYN, A. Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and	Hydrology and Solute Uptake in Hillslope Soils on Magnesian Limestone: the Whitwell Wood Project,
BRITTON, L. J. Hydrology of Area 59, Northern Great Plains	Inductively Coupled Plasma-Mass Spectrome- try, W89-03303 5A	W89-02891 2G Patterns of Hillslope Solutional Denudation in
and Rocky Mountain Coal Provinces, Colorado and Wyoming, W89-02501 2E	BUCHANAN, I.	Relation to the Spatial Distribution of Soil Mois- ture and Soil Chemistry over a Hillslope Hollow
Methods for Collection and Analysis of Aquatic	Comparison of Flow-Through and Towed Fluorometers for Measuring Oil Concentrations	and Spur,
Biological and Microbiological Samples, W89-02568 7B	in the Sea, W89-03329 5A	W89-02906 2J Runoff and Sediment Production in a Small
	BUCKAU, G.	Peat-Covered Catchment: Some Preliminary Re-
Water Quality Assessment of Arvada Reservoir, Denver Metropolitan Area, Colorado, W89-02562 2H	Characterization of Colloids in Groundwater, W89-02998 2K	sults, W89-02888 2E
	BUFFLE, J.	BURTON, D. T.
BROCCOLI, A. J. Characteristics of Seasonal Snow Cover as Simulated by GFDL Climate Models, W89-02628 2C	Combining Field Measurements for Speciation in Non Perturbable Water Samples: Application to the Iron and Sulfide Cycles in a Eutrophic Lake,	Toxicity of DEGDN, Synthetic-HC Smoke Combustion Products, Solvent Yellow 33 and Solvent Green 3 to Freshwater Aquatic Orga-
BROOKS, M. H.	W89-02645 5B	nisms, W89-02936 5C
Results of Intercomparison Studies for the Measurements of pH and Specific Conductance at	BUGLIOSI, E. F. Hydrologic Reconnaissance of the Chilkat River	BUSCH, J. R.
National Atmospheric Deposition Program/Na- tional Trends Network Monitoring Sites, Octo-	Basin, Southeast Alaska (with Special Reference to the Bald Eagle Critical Habitat at the Tsirku	Microcomputer Program Development for On- Farm Irrigation Systems Planning,
ber 1981-October 1985, W89-02485 5A	River Alluvial Fan), W89-02565 2E	W89-02550 6A
BROSE, R. J. Recognizing Petroleum Hydrocarbon Contami- nation in the Vadose Zone with Photoionization	BUKATA, R. P. Relationships Among Secchi Disk Depth, Beam Attenuation Coefficient, and Irradiance Attenu-	BUSH, K. A. SPREX Hydrographic Data Report, Volume 3 - Chlorophyll and Nutrients, W89-03323 2L
Detection Scanning of Field Samples, W89-02351 5A	ation Coefficient for Great Lakes Waters, W89-03176 2H	BUSH, P. W.
BROSTEN, T. M. Supplemental Arsenic Data for Selected Streams in the Missouri River Basin, Montana, 1987, W89-02516 5B	BULLARD, T. F. Description of Piezometer Nests and Water Levels in the Rio Grande Valley Near Albuquerque, Bernalillo County, New Mexico,	Summary of the Hydrology of the Floridan Aq- uifer System in Florida and in Parts of Georgia, South Carolina, and Alabama, W89-03034 2F
	W89-02509 2F	
BROWN, C. S. Bed Topography Inferred From Airborne Radio-Echo Sounding of Columbia Glacier, Alaska, W89-03022 2C	BURCH, A. R. Development Control Procedures in England and Wales, W89-02748 6F	BUTCHER, J. B. Advisory System for North Carolina Ground- water Quality Modeling and Management Needs, W89-02548 5G
	BURCH, M. B.	
BROWN, H. A. Stable Isotopes: An Investigation into Their Application in Karst Hydrology in the U.K., with Special Reference to the Malham Area, North	Chlorine Sensitivity of Early Life Stages of Freshwater Fish, W89-03333 5C	BUTLER, J. H. Cycling of Methane, Carbon Monoxide, Nitrous Oxide, and Hydroxylamine in a Meromictic,
Yorkshire, W89-02734 2F	BURGER, G. Aerobic Treatment of Sewage from Lignite	Coastal Lagoon, W89-03191 2L
BROWN, S.	(Brown Coal) Processing,	BUTLER, M.
Forested Wetlands in Freshwater and Salt- Water Environments,	W89-02915 5D BURGIS, M. J.	Peak/Risk/Culvert: A Program to Compute Peak Flows, Hydrologic Risk, and Circular Cul-
W89-03265 2H	Natural History of Lakes, W89-02775 2H	vert Sizes at Forest Road Crossings, W89-02831 2E
BROWN, S. M. Groundwater Assessment Modeling Under the Resource Conservation and Recovery Act,	BURKHAM, D. E. Method for Delineating Flood-Prone Areas in	BUZSKA, P. M. Relation of Water Chemistry of the Edwards
W89-02995 5B	the Great Basin of Nevada and Adjacent States, W89-02500 2E	Aquifer to Hydrogeology and Land Use, San Antonio Region, Texas,
BRUTON, J. E. Relationships Among Secchi Disk Depth, Beam	BURLEIGH, D.	W89-02514 5B
Attenuation Coefficient, and Irradiance Attenuation Coefficient for Great Lakes Waters,	Gastrointestinal Absorption of Soluble Uranium from Drinking Water, W89-02957 5B	CAIL, C. R. Saline Seep on Wheatland in Northwest Oklaho-
W89-03176 2H	BURNETT, A. D.	ma, W89-02672 5B
BRUTON, M. N. Conservation Management Options for Rivers, W89-02989 6A	Assessment of Hydrogeological Features Using the Technique of Terrain Classification,	CAIN, D.
		Relations of Specific Conductance to Stream- flow and Selected Water Quality Characteristics
BRUWER, C. A. Monitoring and Surveillance, W89-02991 7B	BURNS, A. W. Computer-Program Documentation of an Inter- active-Accounting Model to Simulate Stream-	of the Arkansas River Basin, Colorado,

BURNS, A. W. Computer-Program Documentation of an Inter-active-Accounting Model to Simulate Stream-

CAIRNCROSS, S.

CAIRNCROSS, S. Engineering, Mosquitoes and Filariasis: A Case	CARTER, H. H. Oceanography of Chesapeake Bay, W89-02693 2L	CHAPMAN, R. Djinnang II: A Facility to Study Mixing in Stratified Waters,
Report, W89-03065 5G	11.00	W89-02701 7B
CAIRNS, M. A.	CARTWRIGHT, P. S. Membrane Separation Processes for Industrial	CHARLES, D. F.
Chronic Effects of Contaminated Sediment on Daphnia magna and Chironomus tentans, W89-03312 5C	Effluent Treatment, W89-02806 5D	Aquatic Macrophytes in Adirondack (New York) Lakes: Patterns of Species Composition in
	CASADO, C.	Relation to Environment, W89-03056 5C
CAMBRAY, J. A. Research and Information Needs,	Effects of Hydroelectric Scheme on Fluvial Ecosystems within the Spanish Pyrenees,	
W89-02993 2H	W89-03138 6G	CHARLES, F. L. Evapotranspiration of Native Vegetation in the
CAMPBELL, J. B. Rainfall-Runoff Data for Somerset County, New Jersey,	CASPERS, N. Critical Assessment of the 'Dynamic Daphnia Test' (Kritische Betrachtung des 'Dynamischen	Closed Basin of the San Luis Valley, Colorado, W89-02481 2D
W89-02592 2E	Daphnien Tests'), W89-03046 5A	Evapotranspiration of Phreatophytes in the San Luis Valley, Colorado,
CAMPBELL, P. G. C. Effect of pH on Iron and Manganese Uptake by	CASTELLANO, L.	W89-02478 2D
a Green Alga, W89-03246 5C	Application of a Transport-Diffusion Model to a Coastal Aquifer Utilizing In situ Measurements	CHEN, C. W.
	of Dispersivity,	Sensitivity of Meander Lake to Acid Deposition, W89-03110 5C
Partitioning of Trace Metals in Sediments, W89-02649 5B	W89-03016 2F	W89-03110 5C
CANFIELD, D. E.	CASTLEBERRY, R. D.	CHEN, M.
Influence of Nutrient Enrichment and Light Availability on the Abundance of Aquatic Ma-	Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama;	Development and Achievements of Hydrogeolo- gical Mapping in China,
crophytes in Florida Streams,	Area 8, W89-02564 5B	W89-02370 2F
W89-03231 5C		CHEN, S. J.
CANTER, L. W.	CECH, T. V. Conjunctive Use of Surface and Ground Water	Anaerobic Fluidized Bed Treatment of an Indus- trial Wastewater,
Nitrates and Pesticides in Ground Water: An Analysis of a Computer-Based Literature	in the South Platte, River Basin: A Case Study of the Central Colorado Water Conservancy	W89-03162 5D
Search, W89-02666 5B	District,	CHENG, G. C.
CANTERO, D.	W89-02659 6D	Economic Evaluation of Carbon Adsorption/
Thermophilic Anaerobic Digestion of Winery Waste (Vinasses): Kinetics and Process Optimi-	CHAKRABARTI, T. Biodegradation of Recalcitrant Industrial	Ion Exchange Wastewater Treatment Options for Sunflower AAP NQ Wastewater Treatment
zation,	Wastes, W89-02926 5D	Facility, W89-02828 5D
W89-03114 5D		CHENG, K. Y.
CAO, H. H. Bed Load Discharge Equations for Steep Moun-	CHALUPA, M. Problems in Czechoslovakia Regarding Methods	Partitioning of Toxic Organic Compounds on
tain Rivers, W89-02445	of Removal of Nitrates from Drinking Water, W89-03098 5D	Municipal Wastewater Treatment Plant Solids, W89-02299 5D
		CHENG, R. T.
CAPACCIO, R. S. Environmental Auditing: Management's Key to	CHAN, M. Electrolytic Recovery Theory, Application, Ad-	Eulerian and Lagrangian Modeling of Estuarine
Effective Environmental Compliance, W89-02409 6A	vantages, W89-02407 5D	Hydrodynamics, W89-02691 2L
CAPLESCU, L.		
Sources of Sediment and Channel Changes in Small Catchments of Romania's Hilly Regions,	CHANDLER, W. S. SPREX Hydrographic Data Report, Volume 3 Chlorophyll and Nutrients,	CHERRY, J. A. Migration of Acidic Groundwater Seepage from
W89-02896 2J	W89-03323 2L	Uranium-Tailings Impoundments: 1. Field Study and Conceptual Hydrogeochemical Model,
CAPONE, D. G. Comparison of Microbial Dynamics in Marine	CHANEY, R. L.	W89-03037 5B
and Freshwater Sediments: Contrasts in Anaero- bic Carbon Catabolism, W89-03257 2H	Metal Speciation and Interactions among Ele- ments Affect Trace Element Transfer in Agri- cultural and Environmental Food-Chains, W89-02650 5B	Migration of Acidic Groundwater Seepage from Uranium-Tailings Impoundments: 2. Geochemi- cal Behavior of Radionuclides in Groundwater,
CAREY, J. H.	CHANG, A. T. C.	W89-03038 5B
Photodegradation of the Lampricide 3-Trifluor- omethyl-4-nitrophenol (TFM): 2. Field Confir- mation of Direct Photolysis and Persistence of	Nimbus-7 SMMR Snow Cover Data, W89-02622 7C	Migration of Acidic Groundwater Seepage from Uranium-Tailings Impoundments: 3. Simulations of the Conceptual Model with Application to
Formulation Impurities in a Stream During	CHANG, C. P.	Seepage Area A,
Treatment, W89-03175 5B	Tropical and Monsoonal Studies, W89-02968 2B	W89-03039 5B
CARLETON, T.	CHANG, F.	CHEW, D. L.
Fertility and Disturbance Gradients: A Summa-	Quantitative Studies of Biodegradation of Petro-	Clam Shell Dredging in Lakes Pontchartrain and Maurepas, Louisiana,
ry Model for Riverine Marsh Vegetation, W89-03294 2H	leum And Some Model Hydrocarbons in Ground Water and Sediment Environments,	W89-02715 6G
CARLING, P. A.	W89-02674 5B	CHILDERS, D.
Time-Varying Stochastic Model of the Frequency and Magnitude of Bed Load Transport	CHANG, H. H. Modelling Fluvial Processes in Streams with	Hydrologic Data for Computation of Sediment Discharge, Toutle and North Fork Toutle
Events in Two Small Trout Streams,	Gravel Mining,	Rivers near Mount St. Helens, Washington, 1980-84.
W89-02459 2J	W89-02462 2E	W89-02571 7C
CARLTON, R. G. Phosphorous Flux from Lake Sediments: Effect	CHANT, L.	
		CHIN, E. H.

CHIU, L. S. Satellite Rainfall Retrieval by Logistic Regression,	COBB, R. H. Geohydrology and Susceptibility of Coldwater Spring and Jacksonville Fault Areas to Surface	CORNETT, R. J. Pu(239,240) Residence Times in Freshwaters and Accumulation in Shield Lake Sediments,
W89-02854 7C	Contamination in Calhoun County, Alabama, W89-02576 5B	W89-03209 2H
CHIU, S. Y. Modeling Groundwater Transport of Dissolved Gasoline and Using the Results to Evaluate Aq-	Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama;	CORY, D. C. Toward Sustaining a Desert Metropolis: Water and Land Use in Tucson, Arizona,
uifer Restoration Processes, W89-03321 5B	Area 8, W89-02564 5B	W89-02637 6D
CHRISTOPHERSEN, N. Critique of Models for Freshwater and Soil Acidification, W89-02967 5B	COHEN, S. J. Potential Impacts of a Scenario of CO2-Induced Climatic Change on Ontario, Canada, W89-03063 2A	COSTA, J. E. Hydrology, Geomorphology, and Dam-Break Modeling of the July 15, 1982, Lawn Lake Dam and Cascade Lake Dam Failures, Larimer County, Colorado,
CHRY, J.	COLE, H.	W89-03027 8A
U.S. Geological Survey Urban-Stormwater Data Base of Constituent Storm Loads; Characteris- tics of Rainfall, Runoff, and Antecedent Condi- tions; and Basin Characteristics,	Iodine Speciation in Chesapeake Bay Waters, W89-03277 2L COLE, J. J.	COSTANTINO, C. J. Influence of Ground Water on Soil-Structure Interaction,
W89-02581 7C	Nitrogen Fixation in Freshwater, Estuarine, and Marine Ecosystems: 1. Rates and Importance,	W89-02850 2F COTTRILL, S. M.
CHU, I. Results of a Short-Term Toxicity Study for	W89-03254 2H	Development and Field Use of a Snow Collec-
Three Organic Chemicals Found in Niagara River Drinking Water,	Nitrogen Fixation in Freshwater, Estuarine, and Marine Ecosystems: 2. Biogeochemical Con-	tor for Acid Precipitation Studies, W89-02945 5B
W89-03310 5C	trols, W89-03255 2H	COUFAL, G.
CHURCH, M. Experimental Method in Geomorphology,	COLLINS, D. N.	Use of Well Packers To Control TCE and PCE Contaminants,
W89-02913 2E	Hydrology and Hydrologists, W89-02727 2A	W89-02356 5G
CHURCH, M. A. River Bed Gravels: Sampling and Analysis,	Snow and Ice, W89-02722 2C	COUILLARD, D. Modeling of Total Nitrogen in River Using the Quantity-Quality Model CEQUEAU (Modelisa-
W89-02433 7B		tion de l'Azote Total en Riviere a l'Aide du
CHUTTER, F. M. Monitoring and Surveillance, W89-02991 7B	COMBA, P. G. Pilot Scale Results of Metal Value Recovery from Mixed Metal Hydroxide Sludges,	Modele Quantite-Qualite CEQUEAU), W89-03130 5B
CLAIBORNE, M.	W89-02394 5D	COULLARD, D. Syntrophic Bacteria Process to Convert a Pulp
Bibliography of U.S. Geological Survey Reports on the Water Resources of Florida, 1886-1984, W89-02527 10C	CONGER, D. H. Estimating Magnitude and Frequency of Floods for Wisconsin Urban Streams,	Mill's Spent Sulphite Liquor to Hydrogen Sul- phide,
	W89-03003 2E	W89-03115 5D
CLAIR, T. A. Organic Contaminants in Isolated Lakes of Southern Labrador, Canada, W89-03318 5B	Sediment Record of Biogeochemical Responses to Anthropogenic Perturbations of Nutrient	COUSINS-LEATHERMAN, C. S. Developing a State Ground Water Policy in the Corn Belt: the Iowa Case, W89-02681 2F
CLARK, R. Evaluation of Municipal Solid Waste Landfill	Cycles in Lake Ontario, W89-03222 2H	COX, N. J.
Cover Designs, W89-02871 5E	Silica and Phosphorus Flux from Sediments: Im- portance of Internal Recycling in Lake Michi-	Relationship Between Soil Creep Rate and Cer- tain Controlling Variables in a Catchment in Upper Weardale, Northern England,
CLARKE, A. D. Soot from Arctic Haze: Radiative Effects on the	gan, W89-03219 2H	W89-02905 2J
Arctic Snowpack,	CONVERY, J. J.	COX, W. B. Field Study of Ephemeral Stream-Aquifer Inter-
W89-02611 2C CLOKE, P. S.	Municipal Wastewater Treatment Technology Transfer Activities of the United States Environ- mental Protection Agency,	action, W89-02349 2F
Estimating the Transport and Deposition of	W89-03325 5D	COXON, C.
Mining Waste at Ok Tedi, W89-02461 2J	COOPER, J. C. Review of Environmental Toxicity of Quater-	Groundwater Flow in the Lowland Limestone Aquifer of Eastern Co. Galway and Eastern Co.
CLOUGH, R. W. Dynamic Reservoir Interaction with Monticello	nary Ammonium Halides.	Mayo, Western Ireland,
Dam, W89-02848 8A		COYLE, J. A.
CLUIS, D. Modeling of Total Nitrogen in River Using the		Control of Volatile Organic Contaminants in Groundwater by In-Well Aeration, W89-02955 5F
Quantity-Quality Model CEQUEAU (Modelisation de l'Azote Total en Riviere a l'Aide du Modele Quantite-Qualite CEQUEAU),	Interpretation of 'Controlled' vs 'Natural' Ex-	CRABIREE, R. W.
W89-03130 5E	periments in Streams, W89-03117 7A	Project,
CLUIS, D. A. Index of Water Quality Permitting Environmental Follow-up and Assessment of Local Impact		W89-02891 2G Patterns of Hillsiope Solutional Denudation in
(Indice de Qualite de l'Eau Permettant le Suiv Environnemental et la Mesure des Impact	Measurements, and Chemical Analyses of Groundwater in Harris and Galveston Counties	Relation to the Spatial Distribution of Soil Mois
Locaux), W89-03131 50	Texas 1980-84, W89-02497 7C	
CLYMO, R. S. Interactions of Sphagnum with Water and Air	CORDOVA-RODRIGUEZ, J. Surface Water Hydrology,	CRAMER, W. Groundwater Hydrology,

CRANE, F. G.

CRANE, F. G. Pipeflow and Pipe Erosion in the Maesnant Experimental Catchment, W89-02884 2E	CZERWINSKA-BIL, U. New Porous Polymer for Off-Line Preconcentration of Chlorophenols from Water, W89-03286 5A	DAVIES, T. R. H. Problems of Bed Load Transport in Braided Gravel-Bed Rivers, W89-02455 2J
CRELL, W. M. Role of Aquifer Testing in Design of Constant- Head Extraction Systems,	D'ANGLEJAN, B. Change in Sedimentation Following River Diversion in the Eastmain Estuary (James Bay),	DAVIS, A. C. 'Mussel Watch'Measurements of Chemical Pol-
W89-02346 7B	Canada, W89-03186 2J	lutants in Bivalves as One Indicator of Coastal Environmental Quality,
CRESSER, M. Acidification of Freshwaters,	D'ARRAS. D.	W89-02326 5A
W89-02774 5B	Vulnerability Study of the Aubergenville Aqui-	DAVIS, M. E. Configuration and Hydrology of the Pre-Creta-
CRINGAN, M. S. Pesticides in Fish Tissue and Water from Tuttle	fer, W89-03077 5B	ceous Rocks Underlying the Southeastern Coast- al Plain Aquifer System,
Creek Lake, Kansas, W89-03317 5B	DAGUE, B. J. January 1987 Water Levels, and Data Related to	W89-03007 2F
CRIPE, G. M.	Water Level Changes, Western and South-Cen-	DAVIS, P. R.
Acute Toxicity of Malathion, Tetrabromobis- phenol-A, and Tributyltin Chloride to Mysids	tral Kansas, W89-02594 2F	Simulating Underground Mines in a Regional Model, W89-02339 4C
(Mysidopsis bahia) of Three Ages, W89-03203 5C	DAHAB, M. F. Kinetics of Low Solids Bio-denitrification of	
CRISMAN, T. L.	Water Supplies,	DAVIS, R. E. Results of Experiments Related to Contact of
Effect of Temperature on the Chronic Toxicity of Hydrothol-191 to the Fathead Minnow (Pi-	W89-03166 5F	Mine-Spoils Water with Coal, West Decker and
mephales promelas),	DAHNKE, D. R. Pilot Scale Results of Metal Value Recovery	Big Sky Mines, Southeastern Montana, W89-03001 5B
W89-03206 5C CRITTENDEN, J. C.	from Mixed Metal Hydroxide Sludges, W89-02394 5D	DAVIS, T. L.
Use of Rapid Small-Scale Column Tests to Pre-		Wastewater Irrigation of Vegetable Crops, W89-03282 5E
dict Full-Scale Adsorption Capacity and Per- formance,	DAIGGER, G. T. Enhanced Secondary Treatment Incorporating	
W89-02789 5F	Biological Nutrient Removal, W89-03163 5D	DAVIS, W. C. Treatment of Process Wastewater from Petro-
CROSSLEY, A. Consequences of Cloud Water Deposition on	Unit Process Tradeoffs for Combined Trickling	chemical Plant Using a Rotating Biological Con- tactor - A Case Study,
Vegetation at High Elevation, W89-02305 5B	Filter and Activated Sludge Processes, W89-03160 5D	W89-02292 5D
CROTHERS, J. H.	DALBY, D. H.	DAVISON, B. M.
Intertidal Rock, W89-02767 2L	Remote Sensing, W89-02761 7B	Portable Environment Test System: A Field As- sessment of Organotin Leachates. Test and Eval- uation,
CROWDER, B.	Salt Marshes,	W89-03324 5C
Managing Farm Nutrients: Tradeoffs for Sur- face- and Ground-Water Quality,	W89-02762 7B	DAY, J. A.
W89-02833 5G	DANIEL, D. Impacts of Recharge Legislation on Groundwat-	Conservation Management Options for Rivers, W89-02989 6A
CROWDER, B. M. Analysis of Agricultural Nonpoint Pollution	er Management in Arizona, W89-02336 4B	Riverine Ecosystems,
Control Options in the St. Albans Bay Water- shed.		W89-02986 2H
W89-02419 5G	DANIIL, E. I. Temperature Dependence of Liquid Film Coef-	DAY, J. W.
CROWNOVER, J. E.	ficient for Gas Transfer, W89-03112 2K	Freshwater and Marine Coupling in Estuaries of the Mississippi River Deltaic Plain,
Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama,	DAO, T. H.	W89-03271 2E
Area 6, W89-02590 5B	Behavior And Subsurface Transport of Agro-	DAY, R. T.
CROWTHER, J.	chemicals in Conservation Systems, W89-02667 5B	Fertility and Disturbance Gradients: A Summa- ry Model for Riverine Marsh Vegetation,
Chemical Erosion in Tower Karst Terrain, Kinta Valley, Peninsular Malaysia,	DAS, G.	W89-03294 2H
W89-02738 2J	You and Your Drinking Water: Health Implica- tions for the Use of Cation Exchange Water	DE ALBA, P.
Karst Water Temperature and the Shaping of Malham Cove, Yorkshire.	Softeners, W89-03060 5F	Residual Strength of Sand From Dam Failure in the Chilean Earthquake of March 3, 1985
W89-02737 2F	DAVE, N. K.	W89-02851 8D
CUNNINGHAM, A. J.	Migration of Acidic Groundwater Seepage from	DE MARCH, B. G. E. Acute Toxicity of Binary Mixtures of Five Ca
Environmental Auditing: Management's Key to Effective Environmental Compliance, W89-02409 6A	Uranium-Tailings Impoundments: 1. Field Study and Conceptual Hydrogeochemical Model, W89-03037 5B	tions (Cu(2+), Cd(2+), Zn(2+), Mg(2+), and $K(+)$) to the Freshwater Amphipod Gammaru
CURRY, D. S.	Migration of Acidic Groundwater Seepage from	lacustris (Sars): Alternative Descriptive Models W89-03212
Assessment of Empirical Methodologies for Pre- dicting Ground Water Pollution from Agricul-	Uranium-Tailings Impoundments: 2. Geochemi- cal Behavior of Radionuclides in Groundwater.	DE MICHELE, E.
tural Chemicals,	W89-03038 5B	Simplified Laboratory Procedures for DO De
	DAVIES, B. R.	termination (APHA/AWWA/ WPCF Method) W89-02958
CURTIS, G. W. Technique for Estimating Flood-Peak Discharge	Riverine Ecosystems, W89-02986 2H	
and Frequencies on Rural Streams in Illinois, W89-02512 2E	Uses of, and Human Impact on Rivers,	DE MOOR, F. C. Research and Information Needs,
CURTIS, M. F.	W89-02988 4C	W89-02993 21
Emergence of Chironomidae (Diptera) in Fertilized and Natural Lakes at Saqvaqjuac, N.W.T., W89-03216	DAVIES-COLLEY, R. J. Measuring Water Clarity with a Black Disk, W89-03251 7B	DE VITRE, R. R. Combining Field Measurements for Speciatio in Non Perturbable Water Samples: Applicatio

to the Iron and Sulfide Cycles in a Eutrophic Lake, W89-02645 5B	DHARMVANIJ, S. Trace Metal Transport in a Tropical Estuary, W89-03276 2L	Fate of Water Soluble Azo Dyes in the Activat- ed Sludge Process, W89-02935 5D
DECAMPS, H.	DIAL, C. J.	-
Role of Riparian Woods in Regulating Nitrogen	Hazardous Waste Research Pertaining to Metal	DOUCETTE, W. J.
Fluxes Between the Alluvial Aquifer and Sur-	Finishing.	Biological Transformation and Detoxification of
face Water: A Conceptual Model,	W89-02393 5G	7,12-Dimethylbenz(a)anthracene in Soil Systems,
W89-03140 6G	Dagge B	W89-03161 5B
DUITUITED V I	DICKS, B. Macrofauna of Subtidal Sediments Using	DOUGLAS, S. G.
DEFEYTER, K. L. Sediment-Data Sources and Estimated Annual	Remote Sampling,	Rocky Mountain Acid Deposition Model As-
Suspended-Sediment Loads of Rivers and	W89-02764 2L	sessment: Evaluation of Mesoscale Acid Deposi-
Streams in Colorado,		tion Models for Use in Complex Terrain,
W89-02604 2J	Planning Biological Surveys,	W89-02969 5B
DELVIDED C.C.	W89-02760 7B	
DEJARNETTE, S. S.	Processing Sediment Macrofauna Samples,	DOWNEY, J. S.
Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama,	W89-02765 7B	Regional Aquifer System Underlying the North-
Area 6,	DUDGED II II	ern Great Plains in Parts of Montana, North
W89-02590 5B	DIETER, H. H. Problems of the Toxicological Compatibility of	Dakota, South Dakota, and Wyoming: Summa-
	Hydrogen Peroxide in Drinking and Swimming	ry, W89-03033 2F
DELAUNE, R. D.	Pool Water for Humans from the Pharmacokine-	1107-03033
Response of Coastal Plants to Increase in Sub- mergence and Salinity,	tic and Biochemical Points of View (Probleme	DOZIER, J.
W89-03188 2L	Der Humantoxikologischen Vertraglichkeit von	Remote Sensing of Snow Properties in Moun-
	Wasserstoffperoxid in Bade- and Trinkwasser	tainous Terrain,
DELWORTH, T. L.	aus Biochemischer und Pharmakokinetischer	W89-02624 7B
Influence of Potential Evaporation on the Varia-	Sicht),	DRABEIN M
bilities of Simulated Soil Wetness and Climate, W89-03308 2D	W89-03042 5C	DRABKIN, M.
W 67-03306 2D	DINEHART, R. L.	Waste Minimization Audit Report: Case Studies of Minimization of Mercury-Bearing Wastes at a
DEMERS, S.	Vertical Profiles of Velocity and Suspended	Mercury Cell Chloralkali Plant,
Interrelationship Between In Vivo Fluorescence	Sediment in Streams near Mount St. Helens,	W89-02821 5E
of Phytoplankton and Light Beam Transmission	Washington,	7702021
with Reference to Fluorescence Yield, W89-03233 2L	W89-02523 2J	Waste Minimization Audit Report: Case Studies
W 89-03233 2L	DINWIDDIE, G. A.	of Minimization of Solvent Wastes and Electro-
DEMISSIE, M.	Regional Aquifer System Underlying the North-	plating Wastes at a DOD (Department of De-
Preliminary Environmental Assessment of the	ern Great Plains in Parts of Montana, North	fense) Installation,
Contamination Associated with Lake Calumet,	Dakota, South Dakota, and Wyoming: Summa-	W89-02839 5D
Cook County, Illinois, W89-02870 5B	ry, W89-03033 2F	DRESCHEL, T. W.
W 65-02670 3B	W 69-03033 2F	Evaluation of Rain Chemistry Data for the John
UMEMPSEY, C. R.	DIXIT, A. S.	F. Kennedy Space Center, Florida and the
Biological Wastewater Treatment of Azo Dyes,	Scaled Chrysophytes (Chrysophyceae) as Indi-	versity of Central Florida, Orlando, Florida,
W89-03327 5D	cators of pH in Sudbury, Ontario, Lakes,	W89-02708 4C
Fate of Water Soluble Azo Dyes in the Activat-	W89-03227 5A	DREW D D
ed Sludge Process,	DIXIT, S. S.	DREW, D. P.
W89-02935 5D	Scaled Chrysophytes (Chrysophyceae) as Indi-	Groundwater Flow in the Lowland Limestone Aquifer of Eastern Co. Galway and Eastern Co
DENTON, M. B.	cators of pH in Sudbury, Ontario, Lakes,	Mayo, Western Ireland,
Ultra-Trace-Level Determination of Cobalt,	W89-03227 5A	W89-02736 2E
Chromium, and Hydrogen Peroxide by Luminol	DIXON, D. G.	
Chemiluminescence Detected With a Charge-	Growth, Fecundity, and Energy Stores of White	DRIVER, N. E.
Coupled Device,	Sucker (Catostomus commersoni) from Lakes	U.S. Geological Survey Urban-Stormwater Data
W89-03181 7B	Containing Elevated Levels of Copper and Zinc,	Base of Constituent Storm Loads; Characteris
DEVOL, A. H.	W89-03225 5C	tics of Rainfall, Runoff, and Antecedent Condi
Biogenic Gases and the Oxidation and Reduc-	DOBBS, R. A.	tions; and Basin Characteristics, W89-02581 70
tion of Carbon in Amazon River and Floodplain	Partitioning of Toxic Organic Compounds on	NO702301
Waters,	Municipal Wastewater Treatment Plant Solids,	DROUSE, S. K.
W89-03247 2E	W89-02299 5D	National Surface Water Survey: National
Methane Cycling in the Sediments of Lake	DODGE, K. A.	Stream Survey Phase I - Pilot Survey,
Washington,	Results of Experiments Related to Contact of	W89-02842 5C
W89-03249 2H	Mine-Spoils Water with Coal, West Decker and	National Surface Water Survey, Western Lake
DEWALLE P. D.	Big Sky Mines, Southeastern Montana,	Survey (Phase I Synoptic Chemistry) Quality
DEWALLE, F. B. Sewage Hardness and Mortality from Cancer	W89-03001 5B	Assurance Plan,
and Cardiovascular Disease,	DONKERS, C.	W89-02413 2F
W89-03309 5D	Sensitivity of Meander Lake to Acid Deposition,	
	W89-03110 5C	DRUMMOND, R. A.
DEWEY, J. D.	DONNELLY T	Acute Toxicity and Behavioral Effects of Acry
Hydrologic Analysis of the Rio Grande Basin North of Embudo, New Mexico, Colorado and	DONNELLY, T. Fate of COD in an Anaerobic System Treating	lates and Methacrylates to Juvenile Fathea
New Mexico, New Mexico, Colorado and	High Suiphate Bearing Wastewater,	Minnows, W89-03313 50
W89-02589 2F	W89-02295 5D	W89-03313 50
		DU MOULIN, G. C.
DEWEY, K. F.	DORSEY, M. E.	Concentration of Mycobacterium avium by Hor
Relationship Between Snow Cover and Atmos- pheric Thermal and Circulation Anomalies,	Hydrologic and Geologic Data for the Edwards Aquifer Recharge Zone Near Georgetown, Wil-	pital Hot Water Systems,
W89-02608 2C	liamson County, Texas, 1986-87,	W89-03304 5
07-02000	W89-02499 2F	P1/P010 1
DEXTER, J. J.		DUBOIS, J.
Measurement of Groundwater Velocity with a	DOSTAL, K. A.	Impacts of Recharge Legislation on Groundwa
Colorimetric Borehole Dilution Instrument,	Biological Wastewater Treatment of Azo Dyes,	er Management in Arizona, W89-02336 4
W89-02345 7B	W89-03327 5D	W89-02336 4

DUDER, J. N.	EIKEBROKK, B.	ESHLEMAN, K. N.
Rehabilitation of the Kuratau Station in New Zealand, W89-03154 8C	Humic Substances Removal by Alum Coagula- tion: Direct Filtration at Low pH, W89-02795 5F	National Surface Water Survey: National Stream Survey Phase I - Pilot Survey, W89-02842 5G
DUDLEY, T. L.	EISENREICH, S. J.	POTERMANN C
Interpretation of 'Controlled' vs 'Natural' Ex-	Proton Cycling in Bogs: Geographical Variation	ESTERMANN, G. Analysis of Volatile Halogenated Hydrocarbons
periments in Streams,	in Northeastern North America,	on the ppq Scale,
W89-03117 7A	W89-02316 5B	W89-03301 5A
DUMBLETON, E. J.	EL-ASHRY, M. T.	PTTALA M.O.
Upgrading Hydro Turbines: An Operating	New Water Policies for the West,	ETTALA, M. O. Application of Environmental Risk Analysis to
Authority's Experience, W89-03152 8C	W89-02639 6D	Groundwater Protection,
	West in Beefile	W89-03083 5G
DUNNIGAN, M. E. Comparison of In Situ Estimates of Chlorophyll	West in Profile, W89-02631 6D	EUSTANCE, W. E.
a Obtained with Whatman GF/F and GF/C		Flotation Processes,
Glass-Fiber Filters in Mesotrophic to Hypereu-	EL-SABH, M. I.	W89-02975 5D
tophic Lakes,	Physical Oceanography of the St. Lawrence Es- tuary,	WHILE ST. A.
W89-03217 7B	W89-02698 2L	EVANS, N. A. Fiscal Year 1986 Program Report (Colorado
DUPONT, R. R.		Water Resources Research Institute),
In Situ Biological Treatment of Hazardous	ELLINGSON, S. B. Random Survey of VOC's, Pesticides and Inor-	W89-02477 9D
Waste-Contaminated Soils, W89-02923 5D	ganics in Arizona's Drinking Water Wells,	WILLIAMS IN TO
	W89-02344 5A	EVANS, R. D. Scaled Chrysophytes (Chrysophyceae) as Indi-
DUSTIN, C. D. Effects of Simulated Acid Rain on Sugar Maple	ELLIOTT I C	cators of pH in Sudbury, Ontario, Lakes,
Seedling Root Growth,	ELLIOTT, J. G. Sediment-Data Sources and Estimated Annual	W89-03227 5A
W89-03300 5C	Suspended-Sediment Loads of Rivers and	PRIMONI E P
DUTTON, R. J.	Streams in Colorado,	EYTON, J. R. Synoptic-Scale Assessment of Surface Runoff,
Effect of Temperature on the Chronic Toxicity	W89-02604 2J	W89-02703 2E
of Hydrothol-191 to the Fathead Minnow (Pi-	ELLIOTT, R. D.	
mephales promelas), W89-03206 5C	Diagnostic Technique for Targeting during Air-	FABER, J. A. J.
W89-03206 5C	borne Seeding Experiments in Wintertime	Effects of Cadmium Exposure on Feeding of Freshwater Planktonic Crustaceans,
DUYSINGS, J. J. H. M.	Storms over the Sierra Nevada,	W89-03288 5C
Surface and Subsurface Sources of Suspended Solids in Forested Drainage Basins in the	W89-03305 2B	
Keuper Region of Luxembourg,	ELLIS, S. R.	FABER, M. L. National Surface Water Survey, Western Lake
W89-02892 2J	Comparison of Conceptually Based and Regres-	Survey (Phase I – Synoptic Chemistry) Quality
DWIGHT, D.	sion Rainfall-Runoff Models, Denver Metropoli- tan Area, Colorado, and Potential Applications	Assurance Plan,
Corrective Measures for Releases to Ground-	in Urban Areas,	W89-02413 2H
water from Solid Waste Management Units,	W89-02483 4C	FAHNENSTIEL, G. L.
W89-02844 5G	Runoff Characteristics and Washoff Loads from	Dynamics of Lake Michigan Phytoplankton: Re-
DWYER, J. R.	Rainfall-Simulation Experiments on a Street Sur-	lationship to Nitrogen and Silica Fluxes,
Evaluation of Municipal Solid Waste Landfill Cover Designs,	face and a Native Pasture in the Denver Metro-	W89-03230 2H
W89-02871 5E	politan Area, Colorado,	Operations for an Under-Ice Ecology Program,
DVED F B	W89-03036 2E	W89-03179 2H
DYER, K. R. Tidally Generated Estuarine Mixing Processes,	ELROD, J. H.	FAIRCHILD, D. M.
W89-02686 2L	Biology of the Walleye in Lake Sharpe, South	National Assessment of Ground Water Contami-
EBBERT, J. C.	Dakota, 1964-1975, W89-02427 2H	nation from Pesticides and Fertilizers,
Quantity and Quality of Storm Runoff from	W89-02421 2H	W89-02673 5B
Three Urban Catchments in Bellevue, Washing-	Limnological and Fishery Studies on Lake	FALKENGREN-GRERUP, U.
ton, W89-03000 5B	Sharpe, a Main-stem Missouri River Reservoir,	Soil Acidification and Metal Solubility in For-
	1964-1975, W89-02423 2H	ests of Southern Sweden,
EBBESMEYER, C. C.	1107-02-125	W89-02308 5B
Puget Sound: A Fjord System Homogenized with Water Recycled over Sills by Tidal Mixing,	EMERY, J.	FALL, E. W.
W89-02694 2L	Assessing the Health Effects of Floods, W89-02757 2E	In-Situ Hydrocarbon Extraction, A Case Study,
ECK, T. F.	1107-02137	W89-02354 5G
Nimbus-7 Global Cloud Climatology: Part I.	EMMETT, L. F.	FARRELL, L. L.
Algorithms and Validation,	Hydrology and Water Quality at the Weldon Spring Radioactive Waste-Disposal Sites, St.	Corrective Measures for Releases to Ground-
W89-03307 2B	Charles County, Missouri,	water from Solid Waste Management Units,
EDINGER, D. T.	W89-02528 5B	W89-02844 5G
Successful In House Recovery of Solvent, W89-02410 5G	ENDO C	FARRINGTON, J. W.
	ENDO, G. Anaerobic Biological Process for the Prevention	'Mussel Watch'Measurements of Chemical Pol-
EDWARDS, A.	of Noxious Odors in Pulp Manufacturing,	lutants in Bivalves as One Indicator of Coastal
Acidification of Freshwaters, W89-02774 5B	W89-02928 5D	Environmental Quality,
	ENGELS, J. L.	W89-02326 5A
EDWARDS, D. G. Development, Management, and Analysis of a	National Surface Water Survey, Western Lake	FAUP, G. M.
Long-Term Ecological Research Information	Survey (Phase I Synoptic Chemistry) Quality	Enhanced Biological Phosphorus Removal from
Base: Example for Marine Macrobenthos,	Assurance Plan, W89-02413 2H	Waste Waters, W89-02931 5D
W89-02329 10D		
EGBOKA, B. C.	ENRIGHT, M.	FAWTHROP, N. P.
Groundwater Occurrence and Flow Pattern in the Enugu Coal-Mine Area, Anambra State, Ni-	Seepage Study of A 15.3 Mile Section of the Central Utah Canal, Pahvant Valley, Millard	Mathematical Hydraulic Model of the River Nene a Canalized, and Heavily Controlled
geria,	County, Utah,	River,
W89-03051 2F	W89-02469 2F	W89-03141 4A

FECHTER, L. Treatment of Filter Effluents from Dewatering of Sludges by a New High Performance Floccu-	FISHER, G. Geomembrane Liner Reduces Leakage in Underground Reservoir,	FRANCKO, D. A. Comparison of Phosphorus Dynamics in Two Oklahoma Reservoirs and a Natural Lake Vary-
lation Reactor, W89-02819 5D	W89-03281 5F	ing in Abiogenic Turbidity, W89-03232 2H
	FISK, G. G.	
FEDORAK, P. M. Anaerobic Degradation of Phenolic Compounds with Applications to Treatment of Industrial	Discharge Ratings for Control Structures at McHenry Dam on the Fox River, Illinois, W89-02494 7B	FRECHETTE, P. Sensitivity Analysis of Adsorption and Degrada-
Waste Waters,	FLAGER, J. V.	tion Parameters in the Modeling of Pesticide Transport in Soils,
W89-02918 5D	Hydrology of Area 62, Northern Great Plains	W89-03150 2G
FEKETE, A.	and Rocky Mountain Coal Provinces-New	FREEMAN, W. O.
Regulation of the Agricultural Utilization of Sewage Sludge in New Jersey, W89-02676 5E	Mexico and Arizona, W89-02498 2F	Data-Collection Methods and Data Summary for the Assessment of Water Quality in Cedar
	FLANIGAN, K.	Creek, West-Central Illinois, W89-02520 7B
FELLER, R. J. Development, Management, and Analysis of a Long-Term Ecological Research Information	Field Simulation of Waste Impoundment Seepage in the Vadose Zone, W89-02348 5B	FREEMON, J. M.
Base: Example for Marine Macrobenthos, W89-02329 10D	FLEMER. D. A.	Calpurnia and the Strip Barn, W89-02411 5D
	Monitoring, Research, and Management: Inte-	FREESE, M. E.
FERGUSON, P.	gration for Decisionmaking in Coastal Marine Environments,	Drainage Areas in the James River Basin in
Responses to Acidic Deposition in Ombotrophic Mires in the U.K.,	W89-02323 5A	Eastern South Dakota, W89-02515 7C
W89-02314 5B	FLEMING, J. L.	
FERNANDEZ, J. D.	Selection Guide for Volatilization Technologies	FREIWALD, D. A.
Effect of Long-Term Exposure to Acid, Alumi-	for Water Treatment,	Effects of Fluctuating River-Pool Stages on Groundwater Levels in the Adjacent Alluvial
num, and Low Calcium on Adult Brook Trout	W89-02863 5F	Aquifer in the Lower Arkansas River, Arkansas,
(Salvelinus fontinalis): I. Survival, Growth, Fe- cundity, and Progeny Survival,	FLOODGATE, G. D.	W89-02561 2F
W89-03241 5C	Bacteria and Fungi, W89-02769 7B	FRENCH, J. R. P.
FERNANDEZ, L. P.	W 89-02/09	Effect of Submersed Aquatic Macrophytes on
Waste Water Reduction in Metal Fabrications	FLOWER, R. J.	Resource Partitioning in Yearling Rock Bass (Ambloplites rupestris) and Pumpkinseeds (Le-
Operations, W89-02405 5D	Recent Acidification of a Large Scottish Loch Located Partly within a National Nature Re- serve and Site of Special Scientific Interest,	pomis gibbosus) in Lake St. Clair, W89-03171 2H
FERNANDEZ, R. B.	W89-03125 5C	
Use of Remote Gauging to Measure Sewer	FOLKESON, L.	FRENZEL, S. A. Water Quality Data for the Boise River, Boise to
Invert Elevations and Head Loss, W89-03280 5D	Soil Acidification and Metal Solubility in Forests of Southern Sweden,	Star, Idaho, October to December 1987, W89-02464 5C
FEITIG, J.	W89-02308 5B	FREVERT, K.
Humic Substances Removal by Alum Coagula- tion: Direct Filtration at Low pH,	FONTAINE, T. D. Total Phosphorus Budget for Lake St. Clair:	Analysis of Agricultural Nonpoint Pollution Control Options in the St. Albans Bay Water-
W89-02795 5F	1975-80,	shed, W89-02419 5G
FIELD, E. L.	W89-03168 5B	W69-02419
Economic Evaluation of Carbon Adsorption/ Ion Exchange Wastewater Treatment Options for Sunflower AAP NQ Wastewater Treatment	FORLIN, L. Physiological Disturbances in Fish Living in	FRIEDERICH, H. Controls on the Composition of Authigenic Per- colation Water in the Burren, Ireland,
Facility, W89-02828 5D	Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents,	W89-02730 2K
FIELD, J. A.	W89-03234 5C	FRIEL, E. A.
Role of Phenolic and Humic Compounds in Anaerobic Digestion Processes,	FOSTER, I. D. L. Some Implications of Small Catchment Solute	Hydrology of Area 8, Eastern Coal Province, West Virginia and Ohio, W89-02598 4C
W89-02924 5D	Studies for Geomorphological Research, W89-02902 2E	FROEHLICH, W.
FIELDER, N. A.	FOSTER, J.	Water and Sediment Dynamics of the Homerka
Patterns of Hillslope Solutional Denudation in Relation to the Spatial Distribution of Soil Mois-	Snow Cover Record in Eurasia, W89-02612 2C	Catchment, W89-02895 2J
ture and Soil Chemistry over a Hillslope Hollow and Spur,	FOSTER, J. E.	FROELICH, P. N.
W89-02906 2J	Jefferson Barracks Bridge, Movable-Bed Model Study,	Kinetic Control of Dissolved Phosphate in Natu- ral Rivers and Estuaries: A Primer on the Phos-
FILIP, Z. Microbial Activity in Sanitary Landfills: A Pos-	W89-02417 2J	phate Buffer Mechanism, W89-03253 2K
sible Source of the Humic Substances in	FOSTER, N. W.	
Groundwater, W89-03079 5B	Limits on Cation Leaching of Weakly Podzo- lized Forest Soils: An Empirical Evaluation,	FULLERTON, W. T. Investigation of Sediment Routing by Size Frac-
	W89-02310 5B	tions in a Gravel-Bed River,
FISHER, D. J. Toxicity of DEGDN, Synthetic-HC Smoke	FOWLES, B. K.	W89-02444 2J
Combustion Products, Solvent Yellow 33 and Solvent Green 3 to Freshwater Aquatic Orga-	Monitoring and Surveillance,	FULTON, R. S. Effects of the Blue-Green Alga Microcystis Aer-
nisms,	2011 14 E	uginosa on Zooplankton Competitive Relations,
W89-02936 5C	Photodegradation of the Lampricide 3-Trifluor-	W89-03118 2H
FISHER, D. W.	omethyl-4-nitrophenol (TFM): 2. Field Confir-	
Hydrogeochemistry of the Upper Part of the Fort Union Group in the Gascoyne Lignite		
Strip-Mining Area, North Dakota,	Treatment,	Samples,
W89-03026 4C	W89-03175 5B	W89-03302 5A

FYTIANOS, K.

ous Medium in Presence of Hydrogen Peroxide, W89-03200 5B	Seasonal Changes in Groundwater Levels in the Shallow Aquifers Near Hagerman and the Pecos	Wastewater Treatment: Optimizing an Existing System,
GAGGIANI, N. G.	River, Chaves County, New Mexico, W89-02601 4B	W89-02406 5D
Hydrology of Area 59, Northern Great Plains and Rocky Mountain Coal Provinces, Colorado	W89-02601 4B GARSTANG, M.	GILLER, K. E.
and Wyoming, W89-02501 2E	Design of the Primary Pre-TRMM and TRMM Ground Truth Site,	Acidification and Succession in a Flood-Plain Mire in the Norfolk Broadland, U.K.,
Water Quality Assessment of Arvada Reservoir,	W89-02971 7A	W89-03123 2H
Denver Metropolitan Area, Colorado,	GAUR, J. P.	GIOVINO, J.
W89-02562 2H	Effect of Assam Crude on Photosynthesis and Associated Electron Transport System in Ana-	Two Test Procedures for Radon in Drinking Water: Interlaboratory Collaborative Study,
GALAN, M. A.	baena doliolum,	W89-02956 5A
Thermophilic Anaerobic Digestion of Winery	W89-03207 5C	OTROLIN I E
Waste (Vinasses): Kinetics and Process Optimization,	GAUTHIER, J. M.	GIROUX, J. F. Above- and Below-Ground Macrophyte Pro-
W89-03114 5D	Modeling of Total Nitrogen in River Using the	duction in Scirpus Tidal Marshes of the St.
CALAV V T	Quantity-Quality Model CEQUEAU (Modelisa- tion de l'Azote Total en Riviere a l'Aide du	Lawrence Estuary, Quebec,
GALAY, V. J. River Bed Scour and Construction of Stone	Modele Quantite-Qualite CEQUEAU),	W89-03055 2L
Riprap Protection,	W89-03130 5B	GLASER, J. A.
W89-02442 8A	GAWDZIK, B.	Promising Technologies for the Biological De-
GALE, S. J.	New Porous Polymer for Off-Line Preconcen-	toxification of Hazardous Waste,
Hydrological Development of Tropical Tower	tration of Chlorophenols from Water, W89-03286 5A	W89-03322 5D
Karst: An Example from Peninsular Malaysia, W89-02739 2F		GLASER, P. H.
	GAWDZIK, J.	Natural and Anthropogenic Acidification of
GALLANT, A. L. Ohio Stream Regionalization Project: A Com-	New Porous Polymer for Off-Line Preconcen- tration of Chlorophenols from Water,	Peatlands, W89-02311 5B
pendium of Results,	W89-03286 5A	W 89-02311 3B
W89-02932 2H	GEBERT, W. A.	GLASS, M. W.
GALLIE, T. M.	History of Annual Streamflows from the 21	Spirit Lake, Mount St. Helens, Washington, Limnological and Bacteriological Investigations.
Variable Solute Sources and Hydrological Path-	Water Resources Regions in the United States	Final Report, Volume I,
ways in a Coastal Subalpine Environment, W89-02901 2K	and Puerto Rico, 1951-83, W89-02493 7C	W89-02709 2H
GALLOWAY, W. B.	GERN, W. A.	Spirit Lake, Mount St. Helens, Washington,
'Mussel Watch'Measurements of Chemical Pol-	Effect of Long-Term Exposure to Acid, Alumi-	Limnological and Bacteriological Investigations.
lutants in Bivalves as One Indicator of Coastal	num, and Low Calcium on Adult Brook Trout	Final Report, Volume II, Appendices, W89-02710 2H
Environmental Quality, W89-02326 5A	(Salvelinus fontinalis): II. Vitellogenesis and Os- moregulation,	W 05-02/10 2H
	W89-03242 5C	GLASS, R. L.
GANCARZ, W. J. How Clean Is Clean. (What Constitutes the	GEYH, M. A.	Map Showing Groundwater Levels in Anchor- age, Alaska, 1985,
Clean Closure of a Hazardous Waste Land Man-	Computer Modelling of Confined Aquifer Sys-	W89-02526 7C
agement Facility),	tems for Interpretation of Chemical and Envi-	
W89-02399 5E	ronmental Isotope Data, W89-03015 2F	GOBLET, P. General Review of Methodologies and Ap-
GANCZARCZYK, J. J.		proaches in Mathematical Models for Interpreta-
Utilization of Nitrite Oxidation Inhibition to Im-	GHANAAT, Y. Dynamic Reservoir Interaction with Monticello	tion of Tracer Data in Hydrology,
prove the Nitrogen Elimination Process, W89-02288 5D	Dam,	W89-03011 2F
	W89-02848 8A	GODFREY, P. J.
GANSER, D. R. Design and Construction of a Subsurface Gaso-	GHERINI, S. A.	Fiscal Year 1986 Program Report (Massachu-
line Recovery System Westminster, Colorado,	Sensitivity of Meander Lake to Acid Deposition,	setts Water Resources Research Center), W89-02587 9D
W89-02357 5G	W89-03110 5C	W89-02587 9D
GARCIA DE JALON, D.	GHOBARAH, A.	GOEDDERTZ, J. G.
Effects of Hydroelectric Scheme on Fluvial	Behaviour of Buried Small Flexible Pipes, W89-03137 8G	Offline Bioregeneration of Granular Activated Carbon,
Ecosystems within the Spanish Pyrenees, W89-03138 6G		W89-03103 5D
	GIBBONS, D. C. New Water Policies for the West,	
GARDINER, A. T. Runoff and Sediment Production in a Small	W89-02639 6D	GOETZ, J. E. In Situ Aquifer Denitrification: Remediation o
Peat-Covered Catchment: Some Preliminary Re-	West in Profile,	Ammonia and Nitrate Contaminated Subsurface
sults,	W89-02631 6D	Environments,
W89-02888 2E	GIBBS, J. W.	W89-02359 5C
GARDNER, D. A.	Runoff Characteristics and Washoff Loads from	GOLD, M. E.
Evaluation of Biological Treatment of Pharma- ceutical Wastewater with PAC Addition.	Rainfall-Simulation Experiments on a Street Sur-	Liability for Managing Hazardous Wastes: Past
Volume I,	face and a Native Pasture in the Denver Metro- politan Area, Colorado,	Present and Future,
W89-02948 5D	W89-03036 2E	W89-02398 6E
Evaluation of Biological Treatment of Pharma-	GILEAD, D.	GOLD, R.
ceutical Wastewater with PAC Addition.	Groundwater Contamination by Nitrates and	Hydrology of Area 62, Northern Great Plain
Volume II - Appendices, W89-02949 5D	Chlorides Washed out from Phosphorite Ores in	and Rocky Mountain Coal Provinces-Nev Mexico and Arizona,
	the Negev Desert, Israel, W89-03147 5B	W89-02498 21
GARDNER, W. S.		
Sediment Record of Biogeochemical Responses to Anthropogenic Perturbations of Nutrient	GILES, M. A. Accumulation of Cadmium by Rainbow Trout,	GOLDSMITH, A. L. Development and Field Use of a Snow Collect
Cycles in Lake Ontario,	Salmo Gairdneri, During Extended Exposure,	tor for Acid Precipitation Studies,
W89-03222 2H		W89-02945 5

GOLDSTEIN, B. Use of Saline Water for Buffalo Gourd Produc-	GRADY, C. P. L. Toxicity of Selected RCRA Compounds to Ac-	GRODY, N. C. Snow Cover Monitoring Using Microwave Ra-
tion in New Mexico, W89-02475 3C	tivated Sludge Microorganisms, W89-03165 5D	diometry, W89-02623 7B
GOLTZ, M. N. Simulations of Physical Nonequilibrium Solute Transport Models: Application to a Large-Scale Field Experiment, W89-03148 2F	GRAF, J. B. Aggradation and Degradation of Alluvial Sand Deposits, 1965 to 1986, Colorado River, Grand Canyon National Park, Arizona, W89-02973 2J	GROEGER, A. W. Photosynthetic Carbon Metabolism by Phyto- plankton in a Nitrogen-Limited Reservoir, W89-03215 2H
GOMEZ, L. Sensitivity of Meander Lake to Acid Deposition, W89-03110 5C	GRAF, W. H. Bed Load Discharge Equations for Steep Mountain Rivers, W89-02445 2J	GROENEWOLD, G. H. Hydrogeochemistry of the Upper Part of the Fort Union Group in the Gascoyne Lignite Strip-Mining Area, North Dakota,
GOMEZ MARTOS, M. Use of Linear Compartmental Simulation Approach for Quantitative Interpretation of Isotope Data under Time Variant Flow Conditions, W89-03017 7C	GRAHAM, V. Probability and Stochastic Modelling of Water Quality Parameters in the Thames River, W89-03135 5B	W89-03026 4C GROHMANN, A. N. Chemical Treatment of Flue Gas Washing Liquids.
GOODFELLOW, W. Patapsco Wastewater Treatment Plant Toxicity Reduction Evaluation, W89-02300 5D	GRAINGER, E. H. Influence of a River Plume on the Sea-ice Meiofauna in South-eastern Hudson Bay, W89-03189 2L	W89-02809 5D GROHME, J. Determination of Metals with ICP-AES in Com-
GOODISON, B. E. Snow Surveying in Canada, W89-02614 7B	GREEN, C. H. Social Choice and Benefit-Cost Analysis, W89-02756 6B	parison to the AAS, Photometry, and Millival- Balance of the Anions (Die Metallbestimmung mit der ICP-AES im Vergleich zur AAS, Pho- tometrie und Anionen-Millival-Bilanz), W89-03048
GOODMAN, L. R. Acute Toxicity of Malathion, Tetrabromobis- phenol-A, and Tributyltin Chloride to Mysids (Mysidopsis bahia) of Three Ages, W89-03203 5C	GREEN, S. L. Groundwater Levels in Wyoming, 1978 Through September 1987, W89-02468 4B	W89-03048 5A GROSKOPF, G. R. Phosphate Requirement for Anaerobic Fixed Film Treatment of Landfill Leachate, W89-03132 5D
GOPAL, B. K. Investigation of Nitrate Contamination in Shallow Ground Waters Near Woodward, Oklahoma,	GREENBERG, W. E. Evaluation of Municipal Solid Waste Landfill Cover Designs, W89-02871 5E	GROSS, J. T. Recognizing Petroleum Hydrocarbon Contamination in the Vadose Zone with Photoionization Detection Scanning of Field Samples,
W89-02671 5B GORDON, J. D. Hydrologic Data for Urban Studies in the Austin Metropolitan Area, Texas, 1986,	GREENING, H. Summary of Maryland Stream pH and Alkalinity Data: Analysis of Its Application to Assessing the Impacts of Acidic Deposition, W89-02840 5C	W89-02351 5A GROSSE, D. W. Treatment of Aqueous Metal Bearing Hazardous Wastes.
W89-02597 4C GORDON, L. I. Cycling of Methane, Carbon Monoxide, Nitrous Oxide, and Hydroxylamine in a Meromictic,	GREESON, P. E. Methods for Collection and Analysis of Aquatic Biological and Microbiological Samples, W89-02568 7B	W89-02396 5D GROSZ, G. D. Effects of Fluctuating River-Pool Stages on
Coastal Lagoon, W89-03191 2L GORHAM, E. Natural and Anthropogenic Acidification of	GREGORI, J. Developments in the Design of Bulb Turbines, W89-03069 8C	Groundwater Levels in the Adjacent Alluvial Aquifer in the Lower Arkansas River, Arkansas, W89-02561 2F GRUMM, T.
Peatlands, W89-02311 5B	GREGORY, K. J. Influence of Vegetation on Stream Channel Processes,	In Vitro Genotoxicity of Chlorinated Drinking Water Processed from Humus-Rich Surface Water.
Proton Cycling in Bogs: Geographical Variation in Northeastern North America, W89-02316 5B	W89-02911 2J GREIG, J. K.	W89-03202 5C GRUNTFEST, E.
GOSS, G. G. Blood Gases, Acid-Base Status, Ions, and Hematology in Adult Brook Trout (Salvelinus fontina-	Wastewater Irrigation of Vegetable Crops, W89-03282 5E GRELSSON, G.	Warning Dissemination and Response with Short Lead Times, W89-02754 6F
lis) Under Acid/Aluminum Exposure, W89-03236 5C	Radial Stem Growth of Coniferous Trees near Swedish Reservoirs, W89-03142 6G	GUILLOT, J. R. Water Level Measurements 1981-85 and Chemi-
GOSSE, M. M. Corrective Measures for Releases to Ground- water from Solid Waste Management Units, W89-02844 5G	GRIEPINK, B. Determination of Traces of Thallium in Various Matrices,	cal Analyses 1978-85, Red River Alluvial Aqui- fer, Red River Valley, Louisiana, W89-02582 7C
GOTTSCHALK, L. Hydrological Sciences in Perspective, W89-02718 2A	W89-03067 5A GRIEVE, I. C. Some Implications of Small Catchment Solute Studies for Geomorphological Research,	GULATI, R. D. Effects of Cadmium Exposure on Feeding of Freshwater Planktonic Crustaceans, W89-03288 5C
Hydrology and Data Acquisition, W89-02726 2A Hydrology versus Water Resources Management, W89-02724 2A	W89-02902 2E GRIFFITH, P. C. High-Precision Respirometer for Measuring Small Rates of Change in the Oxygen Concen- tration of Natural Waters.	GULLEY, D. D. Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): I. Survival, Growth, Fecundity, and Progeny Survival,
GRACZYK, D. J. History of Annual Streamflows from the 21	W89-03252 7B GRIMVALL, A.	W89-03241 5C GULLIVER, J. S.
Water Resources Regions in the United States and Puerto Rico, 1951-83, W89-02493 7C	Odour Control by Artificial Groundwater Re- charge, W89-02799 5F	ficient for Gas Transfer,

GUNDERSEN, A. T.

GUNDERSEN, A. T. Biodegradation of Nitrogen- and Oxygen-Con- taining Aromatic Compounds in Groundwater from an Oil-Contaminated Aquifer,	HALL, D. J. Development and Field Use of a Snow Collector for Acid Precipitation Studies, W89-02945 5B	HANNA, P. J. Effects of Temperature, Salinity and Seagrass Species on the Uptake of Lead(II) from Sea- water by Excised Leaves,
W89-03149 5B GUNN, A. M.	HALL, E. R. Pilot-Scale Anaerobic Biomass Acclimation	W89-03275 5B
Trace Metal Speciation in Sediments and Soils: An Overview from a Water Industry Perspec- tive.	Studies with a Coal Liquefaction Wastewater, W89-02297 5D	HANSEN, B. G. U.S. Geological Survey Urban-Stormwater Data Base of Constituent Storm Loads; Characteris-
W89-02651 5B	HALL, M. J. Sediment Transport from Delaware Bay to the	tics of Rainfall, Runoff, and Antecedent Conditions; and Basin Characteristics,
GUNN, J. Stormflow Characteristics of Three Small Lime- stone Drainage Basins in North Island, New	New Jersey Inner Shelf, W89-03187 2J	W89-02581 7C HANSEN, T. F.
Zealand, W89-02735 2A	HALLBERG, G. R. Impacts of Agricultural Chemicals on Ground Water Quality in Iowa,	Water Quality Data for the Boise River, Boise to Star, Idaho, October to December 1987, W89-02464 5C
GUNTHERT, F. W. Industrial Wastewater Pretreatment of a Dental-	W89-02668 5B	
Pharmaceutical Company, W89-02805. 5D	HALLIKAINEN, M. Retrieval of Snow Water Equivalent from	HANSTVEIT, A. O. Literature Study on the Feasibility of Microbiological Decontamination of Polluted Soils,
GURNELL, A. M. Influence of Vegetation on Stream Channel	Nimbus-7 SMMR Data, W89-02621 7B	W89-02916 5G
Processes, W89-02911 2J	HALLIWELL, R. A.	HARDIG, J. Physiological Disturbances in Fish Living in
GURNEY, P. K.	Karst Water Temperature and the Shaping of Malham Cove, Yorkshire, W89-02737 2F	Coastal Water Polluted with Bleached Kraft Pulp Mill Effluents,
Waste Water Reduction in Metal Fabrications Operations,	HALMOE, G.	W89-03234 5C
W89-02405 5D GURTZ, M. E.	Treatment of Oil and Oily Wastes, W89-02963 5G	HARDIN, E. L. Diversity of the Parasite Assemblage of Fundu-
Hydrologic and Riparian Influences on the Import and Storage of Coarse Particulate Or-	HALSELL, D. G. Acute Toxicity of Malathion, Tetrabromobis-	lus zebrinus in the Platte River of Nebraska, W89-03062 2H
ganic Matter in a Prairie Stream, W89-03214 2H	phenol-A, and Tributyltin Chloride to Mysids (Mysidopsis bahia) of Three Ages,	HARKINS, S. M. U.S. Production of Manufactured Gases: Assess-
GUTENTAG, E. D. Effects of Future Ground-Water Pumpage on	W89-03203 5C	ment of Past Disposal Practices, W89-02964 5E
the High Plains Aquifer in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming, W89-03031 2F	HAMA, T. Change in Distribution Patterns of Photosynthe- tically Incorporated C during Phytoplankton Bloom in Controlled Experimental Ecosystem,	HARRIS, J. R. Poultry Manure Management and Ground Water Quality: The Delaware Solution,
Summary of the High Plains Regional Aquifer-	W89-03059 2L	W89-02678 5G
System Analysis in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming, W89-03030 2F	HAMILTON, P. J. Relationship of Surface Pressure Features to the Precipitation and Airflow Structure of an In- tense Midlatitude Squall Line, W89-03274 2B	HARRIS, W. F. Geohydrology and Susceptibility of Coldwater Spring and Jacksonville Fault Areas to Surface Contamination in Calhoun County, Alabama,
H, J. A. Sewage Hardness and Mortality from Cancer	HAMMAN, K. C. D.	W89-02576 5B
and Cardiovascular Disease, W89-03309 5D	Research and Information Needs, W89-02993 2H	Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama,
HADDON, A. M. Estuarine Invertebrates and Fish: Sampling	HAMMOND, S. E.	Area 1, W89-02578 5B
Design and Constraints for Long-Term Meas-	Hydrologic Data for Computation of Sediment Discharge, Toutle and North Fork Toutle	HARRISON, C. W.
urements of Population Dynamics, W89-02327 2L	Rivers near Mount St. Helens, Washington, 1980-84. W89-02571 7C	Improved Fresh Water Assessment in Sand Aquifers Utilizing Geophysical Well Logs, W89-02347 2F
HADDON, P. J. Estuarine Invertebrates and Fish: Sampling	HANCHAK. M. J.	HART, E. D.
Design and Constraints for Long-Term Meas- urements of Population Dynamics, W89-02327 2L	Treatment of Hazardous Wastes in a Sequencing Batch Reactor,	Air Demand and Conduit Pressures, Stillhouse Hollow Dam, Lampasas River, Texas,
HAHN, H. H.	W89-02917 5D HAND, D. W.	W89-02415 8B
Pretreatment of Industrial Wastewater: Legal and Planning AspectsA Case Study, W89-02800 5D	Use of Rapid Small-Scale Column Tests to Pre- dict Full-Scale Adsorption Capacity and Per-	HARTL, G. Rubber Seals for Steel Hydraulic Gates, W89-03074 8G
HAIGH, M. J.	formance, W89-02789 5F	HARTLEY, J. P.
Microerosion Processes and Sediment Mobiliza- tion in a Roadbank Gully Catchment in Central Oklahoma.	HANDA, N. Change in Distribution Patterns of Photosynthe-	Macrofauna of Subtidal Sediments Using Remote Sampling,
W89-02894 2J	tically Incorporated C during Phytoplankton Bloom in Controlled Experimental Ecosystem,	W89-02764 2L
HAJEK, PM. Industrial Wastewater Pretreatment of a Dental-	W89-03059 2L HANDMER, J. W.	Planning Biological Surveys, W89-02760 7B
Pharmaceutical Company, W89-02805 5D	Flood Problem in Perspective, W89-02744 4A	Processing Sediment Macrofauna Samples, W89-02765 7E
HALL, D. H. Influence of Snow Structure Variability on Global Snow Depth Measurement using Micro-	HANEY, J. Dry Wells - Solution or Pollution: An Arizona	HARTMANN, H. C. Historical Basis for Limits on Lake Superior
wave Radiometry, W89-02620 7B	Status Report, W89-02338 5B	Water Level Regulations,

HARTMANN, KH. Pretreatment of Industrial Wastewater: Legal and Planning AspectsA Case Study, W89-02800 5D	HAYNES, B. L. Distribution Pattern and Reduction of Polychlo- rinated Biphenyls (PCB) in Bluefish Pomatomus saltatrix (Linnaeus) Fillets through Adipose	HELWIG, P. C. Canal Design by an Armouring Process, W89-02441 8A
HARTWELL, A.	Tissue Removal, W89-03199 5B	HEMOND, H. F.
Recharge as Augmentation in the South Platte Basin, W89-02482 4B	HEARNE, G. A. Hydrologic Analysis of the Rio Grande Basin	Biogeochemistry of Lead-210 and Polonium-210 in Fresh Waters and Sediments, W89-02555 2K
	North of Embudo, New Mexico, Colorado and	HENEBRY, M. S.
HARVEY, A. M. Sediment Supply to Upland Streams: Influence on Channel Adjustment,	New Mexico, W89-02589 2F	Preliminary Environmental Assessment of the Contamination Associated with Lake Calumet,
W89-02435 2J	HEATH, R. T. Comparison of Phosphorus Dynamics in Two	Cook County, Illinois, W89-02870 5B
HARVEY, R. W. Application of XAD-4 Solid Sorbent and HPLC with Electrochemical Detection to the Analysis	Oklahoma Reservoirs and a Natural Lake Vary- ing in Abiogenic Turbidity,	HENRY, E. C.
of Phenols in Water, W89-02420 5A	W89-03232 2H HEBERT, P. D. N.	Advantages of Suction Lift Hydrocarbon Re- covery Systems: Application At Three Hydro- geologic Environments in California.
HASSAN, M. A. Bed Load Transport in Desert Floods: Observa-	Distribution of Contaminants in Clams and Sedi- ments from the Huron-Erie Corridor: II. Lead and Cadmium,	W89-02358 5G Impact of the Newport-Inglewood Structural
tions in the Negev, W89-02450 2J	W89-03177 5B HECKY, R. E.	Zone on Hydrogeologic Mitigation Efforts: Los Angeles Basin, California,
HASSAN, S. Q.	Comparative Ecology of Marine and Freshwater Phytoplankton,	W89-02342 2F
Treatment of Aqueous Metal Bearing Hazardous Wastes,	W89-03260 2H	HENRY, J. G.
W89-02396 5D HATAKEYAMA, S.	Nutrient Limitation of Phytoplankton in Freshwater and Marine Environments: A Review of	Bacterial Leaching of Heavy Metals from An- aerobically Digested Sludge, W89-02925 5D
Chronic Effects of Cu on Reproduction of Poly- pedilum nubifer (Chironomidae) through Water	Recent Evidence on the Effects of Enrichment, W89-03261 2H	HENRY, M.
and Food, W89-03296 5C	HEDLEY-WHYTE, J. Concentration of Mycobacterium avium by Hospital Hot Water Systems,	Anaerobic Digestion of Chemical Industry Wastewaters Containing Toxic Compounds by Downflow Fixed Film Technology.
HATHAWAY, D. L. Use of a Regional Ground-Water Flow Model	W89-03304 5B	W89-02291 5D
for Water Rights Administration in a Southwest Alluvial Basin, W89-02332 4B	HEEG, J. Uses of, and Human Impact on Rivers, W89-02988 4C	Anaerobic Treatment of Molasse/Sugar Cane Stillage with High Minerals, W89-02289 5D
HATHHORN, W. E.	HEGG, B. A.	
Probability Distribution for Critical DO Location in Streams, W89-03292 7B	Handbook: Improving POTW Performance Using the Composite Correction Program Ap- proach.	HERRICKS, E. E. Innovative Designs for Water Quality Monitor- ing: Are We Asking the Questions Before the
HATVA, T.	W89-02845 5D	Data Are Collected, W89-02320 7A
Treatment of Groundwater with Slow Sand Fil- tration,	HEGG, D. A. Studies of the Mechanisms and Rates with	HERZBRUN, P. A.
W89-03090 5F HAUTH, L. D.	which Nitrogen Species are Incorporated into Cloud Water and Precipitation, W89-02862 5B	Treatment of Hazardous Wastes in a Sequencing Batch Reactor, W89-02917 5D
Annual Yield and Selected Hydrologic Data for the Arkansas River Basin Compact, Arkansas-	HEGGEN, R. J. Ephemeral Runoff and Groundwater Recharge,	HEWLETT, H. W. M.
Oklahoma. 1987 Water Year, W89-02602 2E	W89-02350 2F	Design of Reinforced Grass Waterways, W89-02859 8A
HAVE, M. R. Water Quality Data for Orwell Reservoir and the Otter Tail River Near Fergus Falls, Minne-	HEIDMAN, A. Pilot-Plant Evaluations of Porous Biomass Sup- ports,	HEY, R. D. Flow Processes and River Channel Morpholo-
sota,	W89-03104 5D	gy, W89-02910 2J
W89-02605 5B	HEIDMAN, J. A. Computer Aided Design of Diffused Aeration	River Dynamics, Flow Regime and Sediment
HAWES, J. B. Volunteer Lake Monitoring Program, 1987. Volume I: Statewide Summary Report,	Systems, W89-02947 5D	Transport, W89-02432
W89-02869 7B	HEIM, R.	HIGGINS, R. J.
HAXO, H. E. Factors in Assessing the Compatibility of FMLs and Waste Liquids,	Relationship Between Snow Cover and Atmospheric Thermal and Circulation Anomalies, W89-02608	Estimating the Transport and Deposition of Mining Waste at Ok Tedi,
W89-02952 5E		
HAYES, D. Advantages of Suction Lift Hydrocarbon Re- covery Systems: Application At Three Hydro- geologic Environments in California,	Effects of Future Ground-Water Pumpage on the High Plains Aquifer in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming, W89-03031 2F	Effects of Aeration and Minimum Flow Enhancement on the Biota of Norris Tailwater, W89-02826 5G
W89-02358 5G		HILL, D. W.
Impact of the Newport-Inglewood Structural Zone on Hydrogeologic Mitigation Efforts: Los Angeles Basin, California,	System Analysis in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South	er for Domestic On-Site Sewage Disposal Sys-
W89-02342 2F	Dakota, Texas, and Wyoming, W89-03030 2F	W89-02584 5B
HAYES, J. P. Applying Electrical Resistance Blocks for Un-		HILL, R. U.S. Production of Manufactured Gases: Assess-
saturated Zone Monitoring at Arid Sites, W89-02352 7E	tion and Circulation Investigation, W89-02875 40	ment of Past Disposal Practices, W89-02964 5E

5E

HINELINE, D. W. Use of Rapid Small-Scale Column Tests to Predict Full-Scale Adsorption Capacity and Per-	HOOD, W. K. Statewide Groundwater Quality Monitoring Network Design,	HRUDEY, S. E. Anaerobic Degradation of Phenolic Compounds with Applications to Treatment of Industrial
formance, W89-02789 5F	W89-02343 5A	Waste Waters, W89-02918 5D
	HOOS, A. B. Water Quality of Runoff to the Clarksville Me-	THIL C Y
HINES, A. H. Estuarine Invertebrates and Fish: Sampling Design and Constraints for Long-Term Meas- urements of Population Dynamics,	morial Hospital Drainage Well and of Mobley Spring, Clarksville, Tennessee, February-March 1988,	HUA, S. L. Geological Structure: An Important Factor Controlling Karst Development, W89-02733 2F
W89-02327 2L	W89-02556 5B	
HINKLE, C. R. Evaluation of Rain Chemistry Data for the John F. Kennedy Space Center, Florida and the Uni-	HORNSBY, A. G. Interactive Simulation of Chemical Movement in Soil,	HUBBELL, D. W. Bed Load Sampling and Analysis, W89-02434 2J
versity of Central Florida, Orlando, Florida, W89-02708 4C	W89-02675 5B	HUBER, M.
W89-02708 4C	HOSHIKA, A.	Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale,
HIRANO, M. Precise Measurement of Microforms and Fabric	Mass Balance of Heavy Metals in the Seto Inland Sea, Japan,	W89-03301 5A
of Alluvial Cones for Prediction of Landform	W89-03278 5B	HUDSON, H. A.
Evolution, W89-02908 2J	HOUGHTON, R. L.	Effects of Temperature, Salinity and Seagrass
	Hydrogeochemistry of the Upper Part of the	Species on the Uptake of Lead(II) from Sea- water by Excised Leaves,
HISCOCK, K.	Fort Union Group in the Gascoyne Lignite Strip-Mining Area, North Dakota,	W89-03275 5B
Subtidal Rock and Shallow Sediments Using Diving,	W89-03026 4C	HUDSON, P. M.
W89-02768 7B	HOUZE, R. A.	Comparison of Flow-Through and Towed
HOBBIE, J. E.	Oklahoma-Kansas Mesoscale Convective	Fluorometers for Measuring Oil Concentrations
Comparison of the Ecology of Planktonic Bacte-	System of 10-11 June 1985: Precipitation Struc-	in the Sea, W89-03329 5A
ria in Fresh and Salt Water,	ture and Single-Doppler Radar Analysis, W89-03273 2B	W65-03325
W89-03258 2H		HUESTIS, W. L.
HOBBS, P. V.	HOV, O. Acid Precipitation Literature Review 1986:	Pilot Scale Results of Metal Value Recovery from Mixed Metal Hydroxide Sludges,
Studies of the Mechanisms and Rates with which Nitrogen Species are Incorporated into	Emission, Transport, Transformation and Depo-	W89-02394 5D
Cloud Water and Precipitation,	sition of Acidic Trace Species,	HUFFMAN, G. C.
W89-02862 5B	W89-02822 5B	Groundwater Data for Michigan-1986,
ново, т.	Review of Papers Published in 1985 about Emis-	W89-02495 7C
Xanthene Dye Chemiluminescence for Determi- nation of Free Chlorine in Water, W89-03183 7B	sion, Transport, Transformation and Deposition of Atmospheric Trace Constituents of Impor- tance for Acid Deposition,	HUGGINS, A. W. Diagnostic Technique for Targeting during Air-
HOCKETT, J. R.	W89-02827 5B	borne Seeding Experiments in Wintertime Storms over the Sierra Nevada,
Effect of Long-Term Exposure to Acid, Alumi-	HOWARD, H. K.	W89-03305 2B
num, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Os-	Stringfellow Leachate Treatment with RBC, W89-03328 5D	HUGHES, R. M.
moregulation,	HOWARTH, R. W.	Correspondence Between Ecoregions and Spa-
W89-03242 5C	Nitrogen Fixation in Freshwater, Estuarine, and	tial Patterns in Stream Ecosystems in Oregon, W89-03223 2H
HODDER, E. A.	Marine Ecosystems: 1. Rates and Importance, W89-03254 2H	Ohio Stream Regionalization Project: A Com-
Advantages of Suction Lift Hydrocarbon Re- covery Systems: Application At Three Hydro-		pendium of Results,
geologic Environments in California,	Nitrogen Fixation in Freshwater, Estuarine, and Marine Ecosystems: 2. Biogeochemical Con-	W89-02932 2H
W89-02358 5G	trols,	HULT, M.
HODGES, W. K.	W89-03255 2H	Quantitative Studies of Biodegradation of Petro-
Runoff and Sediment Transport Dynamics in Canadian Badland Micro-Catchments,	HOWE, C. W.	leum And Some Model Hydrocarbons in Ground Water and Sediment Environments,
W89-02887 2E	Water Resources of the Upper Colorado River Basin: Problems and Policy Alternatives,	W89-02674 5B
HOFFMAN, A. D.	W89-02635 6D	HUNDLEY, N.
Acute Toxicity and Behavioral Effects of Acry-	HOWELLS, L.	Great American Desert Transformed: Aridity,
lates and Methacrylates to Juvenile Fathead	Water Resources of Walworth County, South	Exploitation, and Imperialism in the Making of
Minnows, W89-03313 5C	Dakota, W89-02489 2F	the Modern American West, W89-02632 6D
HOFFMAN, P. U.S. Production of Manufactured Gases: Assess-	HOWITT, R. E. Central Valley of California,	HUNGERFORD, D. M. Saline Seep on Wheatland in Northwest Oklaho-
ment of Past Disposal Practices,	W89-02633 6D	ma,
W89-02964 5E	HOY, N. D.	W89-02672 5B
HOLLER, K.	Bibliography of U.S. Geological Survey Reports	HUNGSPREUGS, M.
Uprating the Laufenburg Swiss/German Power Station with Ten Straflo Units, W89-03071 8C	on the Water Resources of Florida, 1886-1984, W89-02527 10C	Trace Metal Transport in a Tropical Estuary, W89-03276 2L
	HOYER, B. E.	HUNT, D. T. E.
HOLMES, R. W. Chemical and Biological Survey of Lakes and	Impacts of Agricultural Chemicals on Ground	Trace Metal Speciation in Sediments and Soils:
Streams Located in the Emerald Lake Water-	Water Quality in Iowa, W89-02668 5B	An Overview from a Water Industry Perspec- tive,
shed, Sequoia National Park,		W89-02651 5B
W89-02852 2H	HOYER, M. V. Influence of Nutrient Enrichment and Light	HUNTLEY, G. M.
HOLZAPFEL-PSCHORN, A.	Availability on the Abundance of Aquatic Ma-	Evaluation of Sodium Aluminate as a Coagulant
Biochemical Testing of Groundwater, W89-03085 5A	crophytes in Florida Streams, W89-03231 5C	for Cost Savings at Water Treatment Plants, W89-02959 5F
JA	11 07-03231 3C	11 07-04737 JF

THIRD C B	INTRACTOR OF D	VARIFORDY A
HUPP, C. R. Dendrogeomorphic Evidence and Dating of Recent Debris Flows on Mount Shasta, North-	IREMONGER, S. F. Responses of Four Irish Wetland Tree Species to Raised Soil Water Levels,	JANICKI, A. Summary of Maryland Stream pH and Alkalinity Data: Analysis of Its Application to Assessing
ern California, W89-03028 2J	W89-03128 2H	the Impacts of Acidic Deposition, W89-02840 5C
Magnitude and Frequency of Debris Flows, and	IRVINE, R. L.	
Areas of Hazard on Mount Shasta, Northern California, W89-03029	Treatment of Hazardous Wastes in a Sequencing Batch Reactor, W89-02917 5D	JANOVY, J. Diversity of the Parasite Assemblage of Fundulus zebrinus in the Platte River of Nebraska,
	IRVING, J. S.	W89-03062 2H
HURFORD, N. Comparison of Flow-Through and Towed Fluorometers for Measuring Oil Concentrations	Cumulative Impact Assessment: Application of a Methodology, W89-02824 7C	JANSSEN, D. B. Literature Study on the Feasibility of Microbiological Decontamination of Polluted Soils,
in the Sea, W89-03329 5A	Cumulative Impact Assessment: Issues to Con-	W89-02916 5G
	sider in Selecting a Cumulative Assessment	JANSSENS, J. A.
HURLEY, M. A. Time-Varying Stochastic Model of the Frequency and Magnitude of Bed Load Transport	Method, W89-02965 5C	Natural and Anthropogenic Acidification of Peatlands,
Events in Two Small Trout Streams, W89-02459 2J	ISAACS, R. G.	W89-02311 5B
HVITVED-JACOBSEN, T. Hydrogen Sulphide Control in Municipal	Review of 183 GHz Moisture Profile Retrieval Studies, W89-02705 7C	JARRETT, R. D. Hydrology, Geomorphology, and Dam-Break
Sewers, W89-02810 5D	ISHII, T.	Modeling of the July 15, 1982, Lawn Lake Dam and Cascade Lake Dam Failures, Larimer County, Colorado,
ICHIM, I. Landsliding, Slope Development and Sediment	Precise Measurement of Microforms and Fabric of Alluvial Cones for Prediction of Landform Evolution.	W89-03027 8A
Yield in a Temperate Environment: Northeast Romania,	W89-02908 2J	JELGERSMA, S. Hydrogeological Mapping in Coastal Areas, W89-02390 2F
W89-02897 2J	ITO, K. Continuous Flow Determination of Carbon Di-	
IIHOLA, H. Aquifer Thermal Energy Storage in Finland,	oxide in Water by Membrane Separation-Chemi- luminescent Detection,	JELIN, J. Identification of a Karst Hydrological System in the Dinaric Karst (Yugoslavia),
W89-03082 4B	W89-03182 7B	W89-03052 2F
ILMAVIRTA, A. Chemical-Biological Treatment versus Chemical	IVERSEN, T. M. Secondary Production and Trophic Relation-	JELUS, M. Partitioning of Toxic Organic Compounds on
Treatment: A Case Study, W89-02814 5D	ships in a Spring Invertebrate Community, W89-03250 2H	Municipal Wastewater Treatment Plant Solids W89-02299 5D
IMBERGER, J. Djinnang II: A Facility to Study Mixing in	JACKSON, D.	JENKINS, K. L.
Stratified Waters, W89-02701 7B	Potential for Treatment of Hazardous Organic Chemicals with Biological Processes, W89-02929 5D	Water Resources Activities of the U.S. Geological Survey in Missouri, Fiscal Year 1987,
IMES, J. L.		W89-02470 90
Groundwater Flow System in Northern Missou- ri with Emphasis on the Cambrian-Ordovician Aquifer,	JACKSON, S. T. Aquatic Macrophytes in Adirondack (New York) Lakes: Patterns of Species Composition in	JENSEN, A. Growth and Phosphorous Status of Limnetic
W89-03023 2F	Relation to Environment, W89-03056 5C	Phytoplankton and Bacteria, W89-03244 2F
IMESON, A. C. Surface and Subsurface Sources of Suspended	JACOBSON, G.	JENSEN, B.
Solids in Forested Drainage Basins in the Keuper Region of Luxembourg,	Assessment and Mapping of Australia's Ground- water Resources,	Potential of Free-Living Ground Water Bacteri to Degrade Aromatic Hydrocarbons and Heter ocyclic Compounds,
W89-02892 2J	W89-02365 2F	W89-03086 51
INGERSOLL, C. G. Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout	JACOT GUILLARMOD, A. F. M. G. River Response to Catchment Conditions, W89-02990 2H	JENSEN, B. K. Biodegradation of Nitrogen- and Oxygen-Com
(Salvelinus fontinalis): I. Survival, Growth, Fe-	JAEGGI, M. N. R.	taining Aromatic Compounds in Groundwate
cundity, and Progeny Survival, W89-03241 5C	Interaction of Bed Load Transport with Bars,	from an Oil-Contaminated Aquifer, W89-03149 51
Physiological Evidence of Acclimation to Acid/	W89-02456 2J	JENSEN, N. A.
Aluminum Stress in Adult Brook Trout (Salve- linus fontinalis): I. Blood Composition and Net	JAFFE, P. R. Model Calibration Based on Random Environ-	Hydrogen Sulphide Control in Municipal Sewers,
Sodium Fluxes, W89-03237 5C	mental Fluctuations, W89-03105 7A	W89-02810 5I JEROME, J. H.
INGRAM, H. M. Toward Sustaining a Desert Metropolis: Water and Land Use in Tucson, Arizona, Web 00627	JALKIAN, R. D. Ultra-Trace-Level Determination of Cobalt, Chromium, and Hydrogen Peroxide by Luminol	Relationships Among Secchi Disk Depth, Bear Attenuation Coefficient, and Irradiance Attenuation Coefficient for Great Lakes Waters,
W89-02637 6D INMAN, E. J.	Chemiluminescence Detected With a Charge- Coupled Device, W89-03181 7B	
Simulation of Flood Hydrographs for Georgia Streams,		Development and Achievements of Hydrogeolo
W89-03002 5E	JAMES, L. G. Principles of Farm Irrigation System Design, W89-02422 3F	gical Mapping in China, W89-02370
IRELAND, R. L. Land Subsidence in the San Joaquin Valley,		Groundwater in China,
California, as of 1980, W89-03018 6G	JAMES, W. F. Contrasting Diel Patterns of Vertical Migration in the Dinoflagellate Ceratium hirundinella in	
Land Subsidence in the Santa Clara Valley, California, as of 1982,	Relation to Phosphorus Supply in a North Tem- perate Reservoir,	Discussion of the Changes in Soil Acidity Do to Natural Processes and Acid Deposition,
W89-03019 6G	W89-03221 2H	W89-02307 5

5B

JOHNSON, G. V.

JOHNSON, G. V.	JOVER, J. P.	KAIZ, C. H.
Soil Testing As a Guide to Prudent Use of Nitrogen Fertilizers in Oklahoma Agriculture, W89-02664 7B	Anaerobic Digestion of Chemical Industry Wastewaters Containing Toxic Compounds by Downflow Fixed Film Technology.	Coastal Monitoring: Evaluation of Monitoring Methods in Narragansett Bay, Long Island Sound and New York Bight, and a General
	W89-02291 5D	Monitoring Strategy,
JOHNSON, K. L. Data on the Distribution and Abundance of Sub-	Anaerobic Treatment of Molasse/Sugar Cane	W89-02325 5A
mersed Aquatic Vegetation in the Tidal Poto-	Stillage with High Minerals,	
mac River and Estuary, Maryland, Virginia, and	W89-02289 5D	KEARL, P. M. Measurement of Groundwater Velocity with a
the District of Columbia, 1986, W89-02511 7C	JUDGE, D. G.	Colorimetric Borehole Dilution Instrument,
	Hydrologic Design Methodologies for Prefeasi-	W89-02345 7B
JOHNSON, R. D. Morphometric Changes in Gill Secondary La-	bility Studies of Small-Scale Hydro at Ungauged	KEDDY, P. A.
mellae of Brook Trout (Salvelinus fontinalis)	Sites, W89-03129 7A	Fertility and Disturbance Gradients: A Summa-
after Long-Term Exposure to Acid and Alumi-		ry Model for Riverine Marsh Vegetation,
num,	JUETTE, B. Hydrogen Sulphide Control in Municipal	W89-03294 2H
W89-03243 5C	Sewers,	KEILTY, T. J.
JOHNSON, R. H.	W89-02810 5D	New Biological Marker Layer in the Sediments
Relationship of Surface Pressure Features to the Precipitation and Airflow Structure of an In-	JUNE, F. C.	of the Great Lakes: Bythothrephes cederstroemi
tense Midlatitude Squall Line,	Biology of the Walleye in Lake Sharpe, South	(Schodler) Spines,
W89-03274 2B	Dakota, 1964-1975,	W89-03178 2H
JOHNSON, W. P.	W89-02427 2H	KELLEHER, C. M.
Hydrologic Data for Computation of Sediment	Biology of the Yellow Perch in Lake Sharpe,	Metal Finishing Wastewater Treatment Upgrade
Discharge, Toutle and North Fork Toutle Rivers near Mount St. Helens, Washington,	South Dakota, 1964-1975, W89-02428 2H	with an Insoluble Sulfide Precipitation Process, W89-02402 5D
1980-84.		W 89-02402
W89-02571 7C	Early Life History and Winter Mortality of Giz- zard Shad in Lake Sharpe, South Dakota,	KELLER, A. E.
JOHNSTON, R. H.	W89-02429 2H	Effect of Temperature on the Chronic Toxicity
Summary of the Hydrology of the Floridan Aq-		of Hydrothol-191 to the Fathead Minnow (Pi- mephales promelas),
uifer System in Florida and in Parts of Georgia,	Limnological and Fishery Studies on Lake Sharpe, a Main-stem Missouri River Reservoir,	W89-03206 5C
South Carolina, and Alabama, W89-03034 2F	1964-1975,	WILLIAM B D
	W89-02423 2H	KELLEY, R. D. Developing a State Ground Water Policy in the
JOLMA, P. Retrieval of Snow Water Equivalent from	Physical, Chemical, and Biological Characteris-	Corn Belt: the Iowa Case,
Nimbus-7 SMMR Data,	tics of Lake Sharpe, South Dakota, 1966-1975,	W89-02681 2F
W89-02621 7B	W89-02424 2H	VELLY D. I
JONES, D. G.	Zooplankton Biomass Exchange in Lake Sharpe,	KELLY, D. L. Responses of Four Irish Wetland Tree Species
Distribution of Gamma-emitting Radionuclides	South Dakota, 1974-1975,	to Raised Soil Water Levels,
in Surface Subtidal Sediments Near the Sella- field Plant,	W89-02425 2H	W89-03128 2H
W89-03190 5B	JUNGERIUS, P. D.	KELLY, M. T.
JONES, E. B. G.	Sources of Variation of Soil Erodibility in Wooded Drainage Basins in Luxembourg,	Temporal Relationship of Vibrio parahaemolyti-
Bacteria and Fungi,	W89-02893 2J	cus in Patients and the Environment,
W89-02769 7B	KAAD I	W89-03064 5B
JONES, H. G.	KAAP, J. Assessing Some Potentials for Changing Agro-	KENNEDY, H. I.
Modeling of Total Nitrogen in River Using the Quantity-Quality Model CEQUEAU (Modelisa-	nomic Practices and Improving Ground Water	Groundwater Levels in Wyoming, 1976
tion de l'Azote Total en Riviere a l'Aide du	Quality: Implications from a 1984 Iowa Survey, W89-02669 5G	Through 1985, W89-02525 7C
Modele Quantite-Qualite CEQUEAU),	W89-02669 5G	W 89-02323
W89-03130 5B	KAHL, J. S.	Groundwater Levels in Wyoming, 1978
JONES, J. A. A.	Comparison of Lake Sediments and Ombrotro- phic Peat Deposits as Long-Term Monitors of	Through September 1987,
Pipeflow and Pipe Erosion in the Maesnant Ex-	Atmospheric Pollution,	W89-02468 4B
perimental Catchment, W89-02884 2E	W89-02321 5A	KENNEY, J. F.
	KAHN, B.	Hydrology of Area 40, Western Region, Interior
JONES, R. A. Assessment of the Degree of Treatment Re-	Fiscal Year 1987 Report (Georgia Water Re-	Coal Province, Kansas, Oklahoma and Missouri, W89-02488 4C
quired for Toxic Wastewater Effluents,	sources Research Institute),	W 03-02400
W89-02303 5D	W89-02553 9D	KENT, M.
JONES, R. D.	KANE, P.	Hydrochemical Characteristics of a Dartmoor Hillslope.
Cycling of Methane, Carbon Monoxide, Nitrous	Suspended Sediment Properties and Their Geo- morphological Significance,	W89-02903 2E
Oxide, and Hydroxylamine in a Meromictic, Coastal Lagoon,	W89-02899 2J	
W89-03191 2L	KAPADIA, D. H.	KERR, S. R.
JORGENSEN, C.	Tunnel and Reservoir Plan Solution to Chica-	Applicability of Fish Yield Indices in Freshwa- ter and Marine Ecosystems,
Potential of Free-Living Ground Water Bacteria	go's Combined Sewer Overflow, Basement	W89-03270 2H
to Degrade Aromatic Hydrocarbons and Heter-	Flooding, and Pollution, W89-03134 4A	VERGII C
ocyclic Compounds, W89-03086 5B		KERSH, G. Pesticides in Fish Tissue and Water from Tuttle
	KARLSSON, I.	Creek Lake, Kansas,
JORGENSON, J. K. Emergence of Chironomidae (Diptera) in Fertil-	Pre-Precipitation for Improvement of Nitrogen Removal in Biological Wastewater Treatment,	W89-03317 5B
ized and Natural Lakes at Saqvaqjuac, N.W.T.,	W89-02812 5D	KESSLER, R. C.
W89-03216 2H	KARVONEN, T.	Rocky Mountain Acid Deposition Model As-
JOUBERT, S. C. J.	Model for Predicting the Effect of Drainage on	sessment: Evaluation of Mesoscale Acid Deposi-
Uses of, and Human Impact on Rivers,	Soil Moisture, Soil Temperature and Crop Yield,	tion Models for Use in Complex Terrain,
W89-02988 4C	W89-03334 4A	W89-02969 5B

KHALLAF, E. A. Effect of Impoundment on the Growth of	KLENZE, R. Characterization of Colloids in Groundwater,	Photodecomposition of Chlorophenols in Aque- ous Medium in Presence of Hydrogen Peroxide,
Bagrus docmac in Lake Nasser, W89-03143 6G	W89-02998 2K	W89-03200 5B
KHORSANDI, F. Predicting Chemical Movement in Soils,	KLEYNHANS, C. J. Conservation Management Options for Rivers, W89-02989 6A	KOSANKE, G. J. Impairment of Mobility and Development in
W89-02473 5B	KLUEH, K. G.	Freshwater Snails (Physa fontinalis and Lym- naea stagnalis) Caused By Herbicides,
KIDD, R. E. Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama;	Sequestration of Iron in Groundwater by Poly- phosphates, W89-03109 5F	W89-03290 5C KOSSAN, D. S.
Area 9, W89-02563 5B	KLUTE, R.	Pilot Plant Demonstration of In-situ Biodegrada- tion of 1,1,1-Trichloroethane,
KIENE, R. P.	Chemically Supported Oil and Grease Removal in Municipal Wastewater Treatment Plants,	W89-03164 5D
Comparison of Microbial Dynamics in Marine and Freshwater Sediments: Contrasts in Anaero- bic Carbon Catabolism.	W89-02813 5D Pretreatment of Wastewater from the Automo-	KOSTER, I. W. Microbial, Chemical, and Technological Aspects of the Anaerobic Degradation of Organic Pollut-
W89-03257 2H	bile Industry, W89-02804 5D	ants, W89-02920 5D
KILHAM, P. Comparative Ecology of Marine and Freshwater	KNAPP, C. M.	KOTAS, J.
Phytoplankton, W89-03260 2H	Maryland Synoptic Stream Chemistry Survey: Estimating the Number and Distribution of Streams Affected By or At Risk from Acidifica-	National Survey of Pesticides in Drinking Water Wells,
Nutrient Limitation of Phytoplankton in Fresh-	tion, W89-02846 5B	W89-02656 5B
water and Marine Environments: A Review of Recent Evidence on the Effects of Enrichment,	KNAPTON, J. R.	KOTT, Y. Movement and Survival of Bacteria in Porous
W89-03261 2H	Supplemental Arsenic Date for Selected Streams	Media,
KILLINGBECK, K. T.	in the Missouri River Basin, Montana, 1987, W89-02516 5B	W89-03080 5B
Hydrologic and Riparian Influences on the Import and Storage of Coarse Particulate Or-	KNEALE, P. E.	KOVACS, G. Attempt to Facilitate Water Management Issues
ganic Matter in a Prairie Stream, W89-03214 2H	Controls on Overland Flow Generation, W89-02882 2E	in the Zambezi River Basin Using Decision Sup- port Systems,
KILROY, K. C.	KNIGHT, C. G.	W89-03145 5G
Geophysical Logs and Hydrological Data for Eight Wells in the Coyote Spring Valley Area,	Synoptic-Scale Assessment of Surface Runoff, W89-02703 2E	KRAMPE, K. D. W. Data Requirements for Hydrogeological Maps,
Clark and Lincoln Counties, Nevada, W89-02603 4B	KNOPMAN, D. S. Analytically-Derived Sensitivities in One-Di-	W89-02387 7A
KIM, C.	mensional Models of Solute Transport in Porous Media.	KRATZ, K.
SPREX Hydrographic Data Report, Volume 3 Chlorophyll and Nutrients,	W89-02595 5B	Chemical and Biological Survey of Lakes and Streams Located in the Emerald Lake Water- shed, Sequoia National Park,
W89-03323 2L	KOCH, N. C.	W89-02852 2H
KIM, J. I. Characterization of Colloids in Groundwater, W89-02998 2K	Records of Wells and Chemical Analyses of Groundwater in Hand and Hyde Counties South Dakota,	KREISSI, J. F. Municipal Wastewater Treatment Technology
KIMMEL, B. L.	W89-02505 2F	Transfer Activities of the United States Environ- mental Protection Agency,
Photosynthetic Carbon Metabolism by Phyto- plankton in a Nitrogen-Limited Reservoir,	KOENIG, L. R. Estimate of Precipitation Enhancement Potential	W89-03325 5D
W89-03215 2H	for the Duero Basin of Spain, W89-03306 3B	KROFTA, M. Development of an Innovative and Cost-Effec-
KING, B. A. Microcomputer Program Development for On-	KOFFSKEY, W. J.	tive Municipal-Industrial Waste Treatment
Farm Irrigation Systems Planning, W89-02550 6A	Experiences with Granular Activated Carbon Filtration and On-Site Reactivation at Jefferson	System, W89-02960 5D
KING, J. M.	Parish, Louisiana, W89-02790 5F	Recent Advances in Magnetic Processes,
River Response to Catchment Conditions, W89-02990 2H	KOK-YOKOMI, M. L.	W89-02961 5D
Riverine Ecosystems,	Diflubenzuron Application to Citrus and Its Impact on Invertebrates in an Adjacent Pond, W89-03208 5C	Treatment of Farnham and Ashley Reservoir Water by Krofta Sandfloat Process System Final Project Report,
W89-02986 2H	KOLEGA, J. J.	W89-02951 5F
KING, M. V. Asbestos-Contaminated Drinking Water: Its Impact on Household Air,	Contribution of Toxic Chemicals to Groundwater for Domestic On-Site Sewage Disposal Sys-	Treatment of Farnham and Ashley Reservoir Water by Krofta Sandfloat Process System -
W89-03299 5B	tems, W89-02584 5B	Project Documentation, W89-02950 5F
KIRKHAM, M. B.	KOMSTA, E.	Treatment of Potable Water from Seoul, Korea
Wastewater Irrigation of Vegetable Crops, W89-03282 5E	Results of a Short-Term Toxicity Study for Three Organic Chemicals Found in Niagara River Drinking Water,	by Flotation, Filtration and Adsorption, W89-03319 5F
KITANO, Y. Mass Balance of Heavy Metals in the Seto	W90.03310 SC	Treatment of Rome Raw Water by Krofta Sand-
Inland Sea, Japan, W89-03278 5B	KONOPKA, A. E.	float Process System Project Documentation (Part A),
KLEESCHULTE, M. J.	W89-02549 SB	W89-02941 5F
Hydrology and Water Quality at the Weldon	KORTE, F.	Treatment of Rome Raw Water by Krofta Sand-
Spring Radioactive Waste-Disposal Sites, St. Charles County, Missouri,	Fate and Effects of Xanthates in Laboratory Freshwater Systems,	float Process System Project Documentation (Part B),
W89-02528 5B		

Treatment of Rome Raw Water by Krofta Sand- float Process System Project Documentation	LACEWELL, R. D. Land and Water Management Issues: Texas	Effect of Long-Term Exposure to Acid, Alumi-
(Part C), W89-02943 5F	High Plains, W89-02634 6D	num, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): I. Survival, Growth, Fe-
		cundity, and Progeny Survival,
KRUG, W. R.	LAFRANCE, P. Sensitivity Analysis of Adsorption and Degrada-	W89-03241 5C
History of Annual Streamflows from the 21 Water Resources Regions in the United States	tion Parameters in the Modeling of Pesticide	TARCEN D. D.
and Puerto Rico, 1951-83,	Transport in Soils,	LARSEN, D. P. Correspondence Between Ecoregions and Spa-
W89-02493 7C	W89-03150 2G	tial Patterns in Stream Ecosystems in Oregon,
PRICED B 1	TACOBY E E	W89-03223 2H
KRUGER, R. L. Cumulative Impact Assessment: Application of a	LAGORY, K. E. Cumulative Impact Assessment: Issues to Con-	W 07-03223
Methodology,	sider in Selecting a Cumulative Assessment	Ohio Stream Regionalization Project: A Com-
W89-02824 7C	Method,	pendium of Results,
	W89-02965 5C	W89-02932 2H
KRUSE, HD. Influence of Sludge from Chemical Biological	TATERNA D. H.	LARSON, D. W.
Wastewater Treatment on Nitrification and Di-	LAHERMO, P. W. Atmospheric, Geological, Marine, and Anthro-	Spirit Lake, Mount St. Helens, Washington,
gestion,	pogenic Effects on Groundwater Quality in Fin-	Limnological and Bacteriological Investigations.
W89-02816 5D	land.	Final Report, Volume I,
ETITOTA III	W89-03076 5B	W89-02709 2H
KUBOTA, T. Calculation of Prototype Cavitation Characteris-	V ANDREW TO D	
tics in Large Bulb Turbines,	LAHEY, T. P. Factors in Assessing the Compatibility of FMLs	Spirit Lake, Mount St. Helens, Washington,
W89-03070 8C	and Waste Liquids,	Limnological and Bacteriological Investigations. Final Report, Volume II, Appendices,
	W89-02952 5E	W89-02710 2H
KUIVILA, K. M. Methane Cycling in the Sediments of Lake		W 65-02710 211
Washington,	LAIRD, G. W.	LARSON, G. L.
W89-03249 2H	Dynamics of Lake Michigan Phytoplankton: Re-	Review of the Crater Lake Limnologica Pro-
	lationship to Nitrogen and Silica Fluxes, W89-03230 2H	grams,
KUMAR, I. J.	W 67-03230	W89-02322 2H
Flotation Processes, W89-02975 5D	LAM, N. D.	I ABSSON A
W 65-02513	Hydrogeological Mapping in the Socialist Re-	LARSSON, A. Physiological Disturbances in Fish Living in
KUMARAN, P.	public of Vietnam,	Coastal Water Polluted with Bleached Kraft
Biological Treatment of Toxic Industrial Waste,	W89-02385 4B	Pulp Mill Effluents,
W89-02919 5D	LAMB, T. E.	W89-03234 5C
KUMARI, K.	Annual Yield and Selected Hydrologic Data for	
Movement of Carbofuran (Nematicide) in Soil	the Arkansas River Basin Compact, Arkansas-	LAVELLE, J. W.
Columns,	Oklahoma, 1987 Water Year,	Formulas for Velocity, Sediment Concentration
W89-03297 5B	W89-02602 2E	and Suspended Sediment Flux for Steady Uni-
KUME, J.	LAMBING, J. H.	Directional Pressure-Driven Flow,
Water Resources of Walworth County, South	Water Quality Data (July 1986 Through Sep-	W89-02779 2J
Dakota,	tember 1987) and Statistical Summaries (March	LAW, R. J.
W89-02489 2F	1985 Through September 1987) for the Clark	Comparison of Flow-Through and Towed
KUNDZEWICZ, Z. W.	Fork and Selected Tributaries from Deer Lodge	Fluorometers for Measuring Oil Concentrations
Hydrological Sciences in Perspective,	to Missoula, Montana,	in the Sea,
W89-02718 2A	W89-02566 5B	W89-03329 5A
M. d d. 134. 1 H	LANDSCHEIDT, A.	YAW Y D
Mathematical Modelling, W89-02725 2A	Polyelectrolytes for the Treatment of Tap and	LAY, J. P. Fate and Effects of Xanthates in Laboratory
W07-02/23	Filter Back Washing Water,	Freshwater Systems,
Surface Water Hydrology,	W89-02797 5F	W89-03201 5G
W89-02719 2E	LANE, J.	1107 00201
KUSLER, J. A.	Nitrogen Fixation in Freshwater, Estuarine, and	LAYER, W.
Design Standards for Building in Flood Hazard	Marine Ecosystems: 1. Rates and Importance,	Evaluation of Sodium Aluminate as a Coagulant
Areas: A Critical Look at US Experience and	W89-03254 2H	for Cost Savings at Water Treatment Plants,
Possible Applications Abroad,	LANE, R. C.	W89-02959 5F
W89-02751 4A	Selected Groundwater Information for the Co-	LAYHER, W. G.
LAAK, R.	lumbia Plateau Regional Aquifer System, Wash-	Pesticides in Fish Tissue and Water from Tuttle
Contribution of Toxic Chemicals to Groundwat-	ington and Oregon, 1982-1985: Volume I, Geo-	Creek Lake, Kansas,
er for Domestic On-Site Sewage Disposal Sys-	hydrology,	W89-03317 5B
tems,	W89-02572 7C	
W89-02584 5B	Selected Groundwater Information for the Co-	LEACH, M.
LABAUGH, J. W.	lumbia Plateau Regional Aquifer System, Wash-	Dry Wells - Solution or Pollution: An Arizona Status Report,
Hydrology and Chemistry of Selected Prairie	ington and Oregon, 1982-1985: Volume II,	W89-02338 5B
Wetlands in the Cottonwood Lake Area, Stuts-	Water Levels,	
man County, North Dakota, 1979-82,	W89-02573 7C	LECKIE, J. O.
W89-03035 2H	LANE, S.	Coordination Chemistry at the Solid/Solution
LABERGE, C.	River Conservation - Implications for Legisla-	Interface,
Index of Water Quality Permitting Environmen-	tion,	W89-02642 5B
tal Follow-up and Assessment of Local Impacts	W89-02992 6E	LEE, D. J.
(Indice de Qualite de l'Eau Permettant le Suivi		Waste Treatment and Recycling of Mixed
Environnemental et la Mesure des Impacts	LANG, G. A.	Wastewater from a Metal Finishing Company,
Locaux), W89-03131 5C	Dynamics of Lake Michigan Phytoplankton: Re- lationship to Nitrogen and Silica Fluxes,	W89-02408 5D
	W89-03230 2H	
LABONTE, M.		LEE, D. W.
Groundwater Contamination at a Landfill Sited	Total Phosphorus Budget for Lake St. Clair:	Review of Groundwater in the Republic of
on Fractured Carbonate and Shale, W89-03146 5B	1975-80, W89-03168 5B	Korea, W89-02376 2F
	W89-03168 5B	W 07-02370 2F

Role of Phenolic and Humic Compounds in LINDBLAD-PASSE, A.

LEE, G. F.

Assessment of the Degree of Treatment Required for Toxic Wastewater Effluents,	Anaerobic Digestion Processes, W89-02924 5D	Clogging Problems in Groundwater Heat Pump Systems in Sweden,
W89-02303 5D	LEVINE, A.	W89-03089 2F
LEE, J. A. Responses to Acidic Deposition in Ombotrophic Mires in the U.K., W89-02314 5B	In Situ Aquifer Denitrification: Remediation of Ammonia and Nitrate Contaminated Subsurface Environments, W89-02359 5G	LINDNER-LUNSFORD, J. B. Comparison of Conceptually Based and Regres- sion Rainfall-Runoff Models, Denver Metropoli- tan Area, Colorado, and Potential Applications
LEE, J. G.	I ENGLING D D	in Urban Areas,
Land and Water Management Issues: Texas	LEWELLING, B. R. Potentiometric Surface of the Intermediate Aq-	W89-02483 4C
High Plains, W89-02634 6D	uifer System, West-Central Florida, September	LINO, M.
1107-02034	1986, W89-02532 7C	Load-Sharing Linings: A New Design Concept
LEE, Y. W.		for Large Diameter Penstocks,
Kinetics of Low Solids Bio-denitrification of Water Supplies,	LEWIN, J.	W89-03158 8F
W89-03166 5F	Valves in Reservoir Outlets, W89-03072 8C	LIOU, M. C.
		Degradation of Bromoform and Chlorodibromo-
LEEKS, G. J. Development of Field Techniques for Assessment of River Erosion and Deposition in Mid-	Chernitte, R. M. Observation of Stratiform Rain with 94 GHz	methane in a Catalyzed H2-Water System, W89-03311 2K
Wales, UK,	and S-Band Doppler Radar, W89-02830 2B	LIPSCOMB, S. W.
W89-02898 2J		Sediment Discharge Data for the Lower Reach
Transport Processes at the Catchment Scale,	LI, C. T. Anaerobic Fluidized Bed Treatment of an Indus-	of Campbell Creek, Anchorage, Alaska: May to
W89-02437 2J	trial Wastewater,	September 1987, W89-02496 2J
	W89-03162 5D	W 65-02470
LEENHEER, J. A. Effects of Organic Wastes from Processing of	11 B	LIPSTEIN, B.
Green River Formation Oil Shale on Water	LI, P. Distribution of Snow Cover in China,	Effect of Activated Sludge in the Breeder Diet
Quality,	W89-02613 2C	on the Reproduction Criteria and the Perform- ance of their Offspring,
W89-02487 5B		W89-03061 5E
LEFEBVRE, Y.	LI, R. M. Investigation of Sediment Routing by Size Frac-	W 07-03001
Index of Water Quality Permitting Environmen-	tions in a Gravel-Bed River,	LITKE, D. W.
tal Follow-up and Assessment of Local Impacts	W89-02444 2J	Calibration of a Dissolved-Solids Model for the
(Indice de Qualite de l'Eau Permettant le Suivi	IDERTI	Yampa River Basin Between Steamboat Springs and Maybell, Northwestern Colorado.
Environnemental et la Mesure des Impacts Locaux).	LIBERTI, L. Influence of Na and Ca Alkalinity on UASB	W89-02591 5B
W89-03131 5C	Treatment of Olive Mill Effluents: I. Preliminary	
	Results,	LIU, C. C. K.
LEGENDRE, L. Interrelationship Between In Vivo Fluorescence	W89-03116 5D	Solute Transport Modeling in Heterogeneous Soils: Conjunctive Application of Physically
of Phytoplankton and Light Beam Transmission	LIBHABER, M.	Based and System Approaches,
with Reference to Fluorescence Yield,	In Situ Biological Groundwater Denitrification:	W89-03151 2G
W89-03233 2L	Concepts and Preliminary Field Tests,	LIVINGSTON, R. K.
LEHMAN, J. T.	W89-03097 5G	Techniques for Estimating Regional Flood
Ecological Principles Affecting Community	LIBRA, R. D.	Characteristics of Small Rural Watersheds in the
Structure and Secondary Production by Zoo- plankton in Marine and Freshwater Environ-	Impacts of Agricultural Chemicals on Ground Water Quality in Iowa, W89-02668 5B	Plains Region of Eastern Colorado, W89-02507 2E
ments, W89-03267 2H		LLOYD, C. S.
	LIDSTROM, M. E.	Birds,
LEIBFRIED, W. C. Effects of Steady versus Fluctuating Flows on	Methane Cycling in the Sediments of Lake Washington,	W89-02772 2L
Aquatic Macroinvertebrates in the Colorado	W89-03249 2H	LOCKE, S. M.
River below Glen Canyon Dam, Arizona,	LIIMATAINEN, A.	Glacio-Eustatic Sea-Level Control on Red Sea
W89-02940 6G	In Vitro Genotoxicity of Chlorinated Drinking	Salinity,
LEKACH, J.	Water Processed from Humus-Rich Surface	W89-03119 2L
Bed Load Transport in Desert Floods: Observa-	Water,	LOCKERBIE, D. M.
tions in the Negev, W89-02450 2J	W89-03202 5C	Organic Contaminants in Isolated Lakes of
W 69-02430	LIM, T. P.	Southern Labrador, Canada, W89-03318 5B
LENFEST, L. W.	Migration of Acidic Groundwater Seepage from	W89-03318 5B
Evapotranspiration Rates at Selected Sites in the Powder River Basin, Wyoming and Montana,	Uranium-Tailings Impoundments: 1. Field Study and Conceptual Hydrogeochemical Model,	LOGAN, L.
W89-02524 2D	W89-03037 5B	Probability and Stochastic Modelling of Water
LEBRARD C.C.	Migration of Acidio Groundwater Sannage from	Quality Parameters in the Thames River, W89-03135 5B
LEPPARD, G. G. Combining Field Measurements for Speciation	Migration of Acidic Groundwater Seepage from Uranium-Tailings Impoundments: 2. Geochemi-	
in Non Perturbable Water Samples: Application	cal Behavior of Radionuclides in Groundwater,	LONGMIRE, P.
to the Iron and Sulfide Cycles in a Eutrophic	W89-03038 5B	Hydrogeologic and Geochemical Aspects of Contaminant Transport at the Falls City, Texas
Lake, W89-02645 5B	LIMONI, N.	UMTRA Site,
	Influence of Na and Ca Alkalinity on UASB	W89-02362 5B
LESHT, B. M.	Treatment of Olive Mill Effluents: I. Preliminary	LOBEZ C B
Nonparametric Evaluation of the Size of Limno-	Results, W89-03116 5D	LOPEZ, G. R. Comparative Ecology of the Macrofauna of
logical Sampling Networks: Application to the Design of a Survey of Green Bay,		Freshwater and Marine Muds,
W89-03174 7A	LIND, W. B.	W89-03268 2H
LETTINGA. G.	Records of Wells, Drillers' Logs, Water Level Measurements, and Chemical Analyses of	LOTSE, E.
Anaerobic Treatment of Sulfate-Containing		Reversibility of Acidification Shown by Whole-
Waste Water,	Texas 1980-84,	Catchment Experiments,
W89-02930 5D	W89-02497 7C	W89-03120 5B

5B

LOUCHART, G. W.

LOUCHART, G. W.	MACKIERNAN, G.	MAPP, H. P.
Howard Plating Clean Up Their Act with Mag- nesium Hydroxide,	Multidecade Trend-Monitoring Program for Chesapeake Bay, A Temperate East Coast Estu-	Ground Water Conservation Techniques: Potential Impacts on Water Usage and Quality,
W89-02401 5D	ary,	W89-02658 3F
LOVE, L. S.	W89-02324 7A	MADOUECIANI P A
Potential for Anaerobic Treatment of High	MACNEIL, J. C.	MARCHEGIANI, E. A.
Sulfur Wastewater in a Unique Upflow - Fixed Film - Suspended Growth Reactor,	Membrane Separation Technologies for Treat- ment of Hazardous Wastes,	Design Problems in Gravel-Bed Rivers, Alaska, W89-02458 2J
W89-02290 5D	W89-03284 5D	MARCHER, M. V.
LOWRY, M. E. Hydrology of the White Tail Butte Area, North- ern Campbell County, Wyoming, W89-02596 4C	MADDEN, C. J. Freshwater and Marine Coupling in Estuaries of the Mississippi River Deltaic Plain, W89-03271 2E	Hydrology of Area 40, Western Region, Interior Coal Province, Kansas, Oklahoma and Missouri, W89-02488
A ATOMO AN AD	MADES, D. M.	MARGAT, J.
LUCE, H. D. Groundwater Protection by Accelerated Testing of Organic Chemical Breakthroughs of Soil Bar- riers,	Estimating Generalized Skew of the Log-Pear- son Type III Distribution for Annual Peak Floods in Illinois,	Report on Hydrogeological Maps of Karstic Terrains, W89-02389 2F
W89-02585 5A	W89-03006 2E	MARIN, C. M.
LUCKEY, R. R.	MADSEN, B, C.	Advisory System for North Carolina Ground-
Effects of Future Ground-Water Pumpage on the High Plains Aquifer in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming,	Evaluation of Rain Chemistry Data for the John F. Kennedy Space Center, Florida and the University of Central Florida, Orlando, Florida, W89-02708 4C	water Quality Modeling and Management Needs, W89-02548 5G
W89-03031 2F	MACADITY M	MARINO, R.
Summary of the High Plains Regional Aquifer- System Analysis in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South	MAGARITZ, M. Contaminated Aquifers are a Forgotten Component of the Global N2O Budget, W89-03121 5B	Nitrogen Fixation in Freshwater, Estuarine, and Marine Ecosystems: 1. Rates and Importance, W89-03254 2H
Dakota, Texas, and Wyoming, W89-03030 2F	Groundwater Contamination by Nitrates and	Nitrogen Fixation in Freshwater, Estuarine, and
LUGO, A. E.	Chlorides Washed out from Phosphorite Ores in the Negev Desert, Israel,	Marine Ecosystems: 2. Biogeochemical Con- trols,
Forested Wetlands in Freshwater and Salt- Water Environments,	W89-03147 5B	W89-03255 2H
W89-03265 2H	MAHAJAN, B. A. Evaluation of Sludge Settleability be Floc Char-	MARKS, R. J.
LUIS, R. M.	acteristics,	Hydrogeological Development in Vanuatu, W89-02368 2F
Hydrogeological Mapping in the Philippines, W89-02382 2F	W89-03167 5D	W 67-02306 2F
W89-02382 2F	MAILVAGANAM, Y.	MARSHALL, S.
LUNDGREN, B. V. Odour Control by Artificial Groundwater Re-	Notes on the Hydrogeological Map of Sarawak, W89-02378 2F	Parameterization of Snow Albedo for Climate Models,
charge,	MAKUCH, J. R.	W89-02626 70
W89-02799 5F	Ground Water and Agriculture: Addressing the	MADOTATE W.D.
LURRY, D. L.	Information Needs of Pennsylvania's Chesa-	MARSHALL, W. D.
Pumpage of Water in Louisiana, 1985,	peake Bay Program,	Chromatographic Approaches to Trace Elemen Speciation,
W89-02506 6D	W89-02680 5G	W89-02648 5A
LUSSIER, D.	MALINOWSKI, K. C.	
Municipal Wastewater Treatment Technology	Treatment of Hazardous Wastes in a Sequencing	MARTIN, E. H.
Transfer Activities of the United States Environ-	Batch Reactor, W89-02917 5D	Assimilative Capabilities of Retention Ponds,
mental Protection Agency, W89-03325 5D	W89-02917 3D	W89-02856 5I
	MALKKI, E.	MARTIN, H. L.
LUTHER, G. W. Iodine Speciation in Chesapeake Bay Waters,	Biological Treatment of Groundwater in Basins with Floating Filters: I. Test Arrangements and	Waste Water Reduction in Metal Fabrication Operations,
W89-03277 2L	General Results, W89-03094 5F	W89-02405 5I
LYKINS, B. W.		
Experiences with Granular Activated Carbon Filtration and On-Site Reactivation at Jefferson	Utilization of Biological Methods in Groundwater Treatment,	MARTIN, W. D. Martins Fork Lake Sedimentation Study: Hy
Parish, Louisiana, W89-02790 5F	W89-03088 5F	draulic Model Investigation,
	MALONEY, S. W.	W89-02780 2
LYNCH, B. W. J.	Economic Evaluation of Air Stripping to	MARTIN, W. E.
Fate of Crude Oil at Sea and the Natural Disper- sion of Crude Oils and Water-in-Oil Emulsions:	Remove Volatile Organic Compounds from	Toward Sustaining a Desert Metropolis: Water
Results of Experiments Using a Laboratory Test	Water, W89-02976 5F	and Land Use in Tucson, Arizona,
Tank and Free-Floating Rings at Sea,		W89-02637 61
W89-02944 5B	MANABE, S.	MARTINELL, R.
MABBETT, A. N.	Influence of Potential Evaporation on the Varia- bilities of Simulated Soil Wetness and Climate,	Modelling of Flow and Transport Processes
Environmental Auditing: Management's Key to Effective Environmental Compliance,	W89-03308 2D	Vyredox and Nitredox Subsurface Treatment
W89-02409 6A	MANN, K. H.	Plants, W89-03092 5
	Production and Use of Detritus in Various	W 67-U3U72
MACGILLIVRAY, A. R.	Freshwater, Estuarine, and Coastal Marine Eco-	VYREDOX and NITREDOX Methods of
Land Treatment of Nitroguanidine Wastewater, W89-02293 5D	systems, W89-03266 2H	situ Treatment of Groundwater,
		W89-03091 5
MACK, F. K.	MANNING, D. L.	MARTIUS, G.
Selected Geohydrologic Characteristics of the Patapsco Aquifer at Chalk Point, Prince		Aerobic Treatment of Sewage from Ligni
Georges County, Maryland,	of Phenols in Water,	(Brown Coal) Processing,
W89.03560	W90 02420 SA	W90 00016

Hydrologic and Riparian Influences on the Import and Storage of Coarse Particulate Or- ganic Matter in a Prairie Stream, W89-03214 2H	Hydrologic Design Methodologies for Prefeasi- bility Studies of Small-Scale Hydro at Ungauged Sites, W89-03129 7A	Advisory System for North Carolina Ground- water Quality Modeling and Management Needs, W89-02548 5G
MASKARINEC, M. P. Application of XAD-4 Solid Sorbent and HPLC with Electrochemical Detection to the Analysis of Phenols in Water,	MCCOLLUM, R. A. Blountstown Reach, Apalachicola River, Movable-Bed Model Study, W89-02416 2J	MEGANCK, M. T. J. Enhanced Biological Phosphorus Removal from Waste Waters, W89-02931 5D
W89-02420 5A	MCCORD, J. T.	MEIER, M. F.
MASSEY: B. C. Floods in Central Texas, August 1-4, 1978, W89-03025 2E	Modeling the Response of Lake-Aquifer Sys- tems to Acid Precipitation, W89-02341 5C	Bed Topography Inferred From Airborne Radio-Echo Sounding of Columbia Glacier, Alaska.
MASSINGILL, R. C.	MCCOROUODALE, J. A.	W89-03022 2C
Water Resources Publications of the U.S. Geological Survey, For Tennessee, 1906-1987,	Experimental Study of Flow in Settling Tanks, W89-03107 8B	Surface Topography of the Lower Part of Co- lumbia Glacier, Alaska, 1974-81,
W89-02467 10C	MCCUTCHEON, S. C.	W89-03021 2C
MATEJKA, T.	Influence of Large Suspended-Sediment Con-	
Oklahoma-Kansas Mesoscale Convective System of 10-11 June 1985: Precipitation Struc-	centrations in Rivers, W89-02451 2J	MEJAC, B. Comparison Between Waste Water Treatment in Completely Mixed and Fluidized Bed Reactors:
ture and Single-Doppler Radar Analysis, W89-03273 2B	MCDONALD, B.	Development and Structure of Biomass (Verg-
MATIS, K. A.	Projections of Water Availability in the Lower Rio Grande, Gila-San Francisco and Mimbres Drainage Basins to 2005,	leich der Absasserreinigung im Ruhr - und im Wirbelbettreaktor Sowie Entwicklung und
Separation of Heavy Metals from Effluents by Flotation,	W89-02474 6D	Struktur der Biomasse), W89-03045 5D
W89-02803 5D	MCDONALD, D. G.	
MATSON, M.	Blood Gases, Acid-Base Status, Ions, and Hema-	MELACK, J. M. Chemical and Biological Survey of Lakes and
NOAA Satellite-Derived Snow Cover Data Base: Past, Present, and Future,	tology in Adult Brook Trout (Salvelinus fontina- lis) Under Acid/Aluminum Exposure,	Streams Located in the Emerald Lake Water- shed, Sequoia National Park,
W89-02617 2C	W89-03236 5C	W89-02852 2H
MATSUMOTO, M. R. Offline Bioregeneration of Granular Activated	Effects of Aluminum and Low pH on Net Ion Fluxes and Ion Balance in the Brook Trout	Survey of Sensitivity of Southern California Lakes to Acid Deposition,
Carbon, W89-03103 5D	(Salvelinus fontinalis), W89-03235 5C	W89-02864 5C
MATTHEWS, J. E. Biological Transformation and Detoxification of 7,12-Dimethylbenz(a)anthracene in Soil Systems,	Physiological Evidence of Acclimation to Acid/ Aluminum Stress in Adult Brook Trout (Salve- linus fontinalis): I. Blood Composition and Net	MELCER, H. Fate of 4,6-Dinitro-o-Cresol in Municipal Activated Sludge Systems,
W89-03161 5B	Sodium Fluxes, W89-03237 5C	W89-02296 5E
MATTHEWS, R. Effects of Acid Mine Drainage on Groundwater Quality at the Leviathan Sulfur Mine, Alpine	Sodium Transport in the Brook Trout, Salve- linus fontinalis: Effects of Prolonged Low pH	MENEGATTI, S. Influence of Na and Ca Alkalinity on UASI Treatment of Olive Mill Effluents: I. Preliminary
County, California, W89-02363 5C	Exposure in the Presence and Absence of Aluminum,	Results, W89-03116 5I
MATTICE, J. S.	W89-03239 5C	MENES, F.
Chlorine Sensitivity of Early Life Stages of Freshwater Fish, W89-03333 5C	MCENROE, B. M. Leachate Collection in Landfills: Steady Case, W89-03102 5E	Effects of Hydroelectric Scheme on Fluvia Ecosystems within the Spanish Pyrenees, W89-03138
MATTSON, E. D. Field Simulation of Waste Impoundment Seep- age in the Vadose Zone,	MCFARLANE, R. D. Data-Collection Methods and Data Summary for the Assessment of Water Quality in Cedar	MERCADO, A. In Situ Biological Groundwater Denitrification Concepts and Preliminary Field Tests,
W89-02348 5B	Creek, West-Central Illinois, W89-02520 7B	W89-03097
MAYER, A. B. Transition from Ground-Water Mining to In-	MCKECHNIE. D.	MERCIER, J.
duced Recharge in Generalized Hydrogeologic Systems,	Processes, Coefficients, and Models for Simulat- ing Toxic Organics and Heavy Metals in Surface	Spatial Variability of Soil Hydrodynamic Pro- erties in the Petite Fecht Catchment, Soultzerer France - Preliminary Results,
W89-02337 4B	Waters, W89-02788 5B	W89-02883 20
MBUMWAE, L. L.		MERGLER, R.
Environmental Management of the Zambezi River System, W89-03144 5G	MCLEAN, D. G. River Bed Gravels: Sampling and Analysis, W89-02433 7B	Biological Degradation of Volatile Chlorinate Hydrocarbons in Groundwater,
		W89-03081 5
MCARTHUR, J. V. Hydrologic and Riparian Influences on the Import and Storage of Coarse Particulate Or- ganic Matter in a Prairie Stream.	MCLIN, S. G. Effects of Irrigation Practices on Stream-Connected Phreatic Aquifer Systems, W89-02661 3F	MESSER, J. J. National Surface Water Survey: Nation Stream Survey Phase I - Pilot Survey,
W89-03214 2H	MCNEILL, J.	W89-02842 5
MCCAIG, M.	Fertility and Disturbance Gradients: A Summa-	MEYER, F. W.
Pattern of Wash Erosion Around an Upland Stream Head,	ry Model for Riverine Marsh Vegetation, W89-03294 2H	Summary of Well Construction, Testing, at Preliminary Findings from the Alligator All- Test Well, Broward County, Florida,
W89-02886 2J	MCQUARRIE, P. M.	W89-02465
MCCAULEY, E.	Distribution of Contaminants in Clams and Sedi-	
Contrasting Patterns of Net- and Nanoplankton Production and Biomass Among Lakes,	ments from the Huron-Erie Corridor: II. Lead and Cadmium,	Seismic Refraction Tests Above Water Tab
W89-03218 2H		W89-03113

MEYERS-SCHULTE, K.

MEYERS-SCHULTE, K. Portable Environment Test System: A Field Assessment of Organotin Leachates. Test and Evaluation.	MITCHELL-HALL, T. E. National Surface Water Survey, Western Lake Survey (Phase I – Synoptic Chemistry) Quality Assurance Plan,	MORIN, G. Modeling of Total Nitrogen in River Using the Quantity-Quality Model CEQUEAU (Modelisa- tion de l'Azote Total en Riviere a l'Aide du
W89-03324 5C	W89-02413 2H	Modele Quantite-Qualite CEQUEAU),
MICHELOT, E. Anaerobic Treatment of Molasse/Sugar Cane	MITCHELL, K. Impacts of Recharge Legislation on Groundwat-	W89-03130 5B MORIN, K. A.
Stillage with High Minerals, W89-02289 5D	er Management in Arizona, W89-02336 4B	Migration of Acidic Groundwater Seepage from Uranium-Tailings Impoundments: 1. Field Study
MICHENER, R. H. Hydrogen (H2) Distributions in the Carmans River Estuary,	MITCHELL, P. I. Groundwater Assessment Modeling Under the	and Conceptual Hydrogeochemical Model, W89-03037 5B
W89-03194 2L	Resource Conservation and Recovery Act, W89-02995 5B	Migration of Acidic Groundwater Seepage from Uranium-Tailings Impoundments: 2. Geochemi-
MICHENER, W. K. Development, Management, and Analysis of a Long-Term Ecological Research Information Base: Example for Marine Macrobenthos, W89-02329 10D	MOBLEY, C. D. Numerical Model for the Computation of Radiance Distributions in Natural Waters with Wind-Roughened Surfaces, Part II: User's Guide and	cal Behavior of Radionuclides in Groundwater, W89-03038 5B Migration of Acidic Groundwater Seepage from
MIHAIU, G.	Code Listing, W89-02414 2H	Uranium-Tailings Impoundments: 3. Simulations of the Conceptual Model with Application to
Sources of Sediment and Channel Changes in Small Catchments of Romania's Hilly Regions, W89-02896 2J	MOFJELD, H. O. Formulas for Velocity, Sediment Concentration and Suspended Sediment Flux for Steady Uni-	Seepage Area A, W89-03039 5B MORRIS, E. M.
MIKLAS, J. J. Estuarine Invertebrates and Fish: Sampling Design and Constraints for Long-Term Meas-	Directional Pressure-Driven Flow, W89-02779 2J	Modelling a Seasonal Snow Cover, W89-02627 2C
urements of Population Dynamics, W89-02327 2L	MOHAMAD, D. B. Pre-Feasibility on Streamflow Gauging Using Radioisotope Tracer Method for Kemumbu Ag-	MORRIS, J. A. Appendicitis Epidemic Following Introduction of Piped Water to Anglesey,
MILDE, G. Biological Degradation of Volatile Chlorinated Hydrocarbons in Groundwater,	riculture Development Authority (KADA), W89-02713 2E	W89-03041 5F
W89-03081 5B MILLER, H.	MONTES, C. Effects of Hydroelectric Scheme on Fluvial	MORRIS, P. Natural History of Lakes, W89-02775 2H
Uprating the Laufenburg Swiss/German Power Station with Ten Straflo Units, W89-03071 8C	Ecosystems within the Spanish Pyrenees, W89-03138 6G MOODY, P. H.	MORRIS, R. E. Rocky Mountain Acid Deposition Model Assessment: Evaluation of Mesoscale Acid Deposi-
MILLER, J. M. Distribution of Gamma-emitting Radionuclides in Surface Subtidal Sediments Near the Sella-	Acute Toxicity of Malathion, Tetrabromobis- phenol-A, and Tributyltin Chloride to Mysids (Mysidopsis bahia) of Three Ages, W89-03203 5C	tion Models for Use in Complex Terrain, W89-02969 5B
field Plant, W89-03190 5B MILLER, K. M.	MOORE, C. A. River Response to Catchment Conditions, W89-02990 2H	MORRISETTE, P. M. Rising Level of the Great Salt Lake: Impacts and Adjustments, W89-03127 6F
Biodegradation Modeling at Aviation Fuel Spill Site, W89-03100 5G	MOORE, C. V.	MORRISON, I. K.
MILLIGAN, C. L.	Central Valley of California, W89-02633 6D	Limits on Cation Leaching of Weakly Podzo- lized Forest Soils: An Empirical Evaluation,
Sodium Transport in the Brook Trout, Salve- linus fontinalis: Effects of Prolonged Low pH Exposure in the Presence and Absence of Alu- minum, W89-03239 5C	MOORE, J. W. Organic Chemicals in Natural Waters: Applied Monitoring and Impact Assessment, W89-02776 5C	W89-02310 5B MORRISSEY, S. Estuaries: Concern Over Troubled Waters, W89-03279 7A
MILLIKEN, J. G. Water Management Issues in the Denver, Colo-	MOORE, M. A. Annual Yield and Selected Hydrologic Data for	MORTON, J. A. Total Phosphorus Budget for Lake St. Clair:
rado, Urban Area, W89-02638 6D	the Arkansas River Basin Compact, Arkansas- Oklahoma, 1987 Water Year, W89-02602 2E	1975-80, W89-03168 5B
MILTNER, R. J.	MOORE, R. M.	MOSLEY, M. P.
Control of Volatile Organic Contaminants in Groundwater by In-Well Aeration, W89-02955 5F	Temporal Variations in Dissolved and Particulate Aluminum During a Spring Bloom, W89-03192 2L	Rapid Subsurface Flow and Streamflow Solute Losses in a Mixed Evergreen Forest, New Zea- land.
MINGES, D. R. Hydrology of Area 59, Northern Great Plains	MOOTY, W. S.	W89-02890 2G
and Rocky Mountain Coal Provinces, Colorado and Wyoming, W89-02501 2E	Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama, Area 7,	MOSSMAN, D. J. Predicting the Effects of a Pesticide Release to the Rhine River,
Techniques for Estimating Regional Flood	W89-02577 5B	W89-03159 5C
Characteristics of Small Rural Watersheds in the Plains Region of Eastern Colorado, W89-02507 2E	MORALES, I. M. Enhanced Secondary Treatment Incorporating Biological Nutrient Removal, W89-03163 5D	MOUL, D. J. Evaluation of the Acute Toxicity to Juvenile Pacific Salmonids of Hexazinone and its Formu- lated Products: Pronone 10G, Velpar L, and
MITCHELL, A. A. Water Resources Activities of the U. S. Geologi- cal Survey in Texas - Fiscal Year 1987, W89-02574 9C	MORAN, S. B. Temporal Variations in Dissolved and Particulate Aluminum During a Spring Bloom,	Their Carriers, W89-03316 5C
MITCHELL, B. Conflicting Objectives in Floodplain Manage-	W89-03192 2L MORGAN, J. A.	MOUNT, D. R. Effect of Long-Term Exposure to Acid, Aluminum, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): I. Survival, Growth, Fe-
ment: Flood Damage Reduction Versus Heritage Preservation, W89-02749 6F	Evapotranspiration of Native Vegetation in the Closed Basin of the San Luis Valley, Colorado, W89-02481 2D	(Salvelinus fontinalis): I. Survival, Growth, Fe- cundity, and Progeny Survival, W89-03241 5C

Effect of Long-Term Expos		MURRAY, J. W.	NEILL, C. R.
num, and Low Calcium on (Salvelinus fontinalis): II. V moregulation,		Methane Cycling in the Sediments of Lake Washington, W89-03249 2H	Sediment Balance Considerations Linking Long- Term Transport and Channel Processes, W89-02438 2J
W89-03242	5C		W89-02438 2J
		MURRAY, T. M.	NEITZER, K. M.
Physiological Evidence of A		Monitoring the Nation's WatersA New Per-	Records of Wells and Chemical Analyses of
Aluminum Stress in Adult		spective,	Groundwater in Hand and Hyde Counties South
linus fontinalis): II. Blood P	'arameters by Cannu-	W89-02318 5A	Dakota,
lation, W89-03238	5C	MUSTARD, M. H.	W89-02505 2F
W 07-03230	30	Runoff Characteristics and Washoff Loads from	NERETNIEKS, I.
MOUNTFORD, K.		Rainfall-Simulation Experiments on a Street Sur-	Solute Transport in Fractured Rocks,
Multidecade Trend-Monit		face and a Native Pasture in the Denver Metro-	W89-03014 2F
Chesapeake Bay, A Temper	rate East Coast Estu-	politan Area, Colorado,	
ary,	••	W89-03036 2E	NERGER, M.
W89-02324	7A	II C. Garlarian Survey Habon Stormunter Date	Biological Degradation of Volatile Chlorinated
MOURSI, A. M.		U.S. Geological Survey Urban-Stormwater Data Base of Constituent Storm Loads; Characteris-	Hydrocarbons in Groundwater,
Experimental Study of Flo	w in Settling Tanks,	tics of Rainfall, Runoff, and Antecedent Condi-	W89-03081 5B
W89-03107	8B	tions; and Basin Characteristics,	NEVISSI, A. E.
MOZA D N		W89-02581 7C	Sewage Hardness and Mortality from Cancer
MOZA, P. N. Photodecomposition of Ch	loronhanols in Acme-		and Cardiovascular Disease,
ous Medium in Presence of		MYERS, A. A.	W89-03309 5D
W89-03200	5B	Statewide Groundwater Quality Monitoring	
		Network Design,	NEWBRY, B. W.
MUELLER, T.		W89-02343 5A	Unit Process Tradeoffs for Combined Trickling
Assessment of the Adequ		NADEAU, J. E.	Filter and Activated Sludge Processes,
Water Monitoring System		Sediment Transport from Delaware Bay to the	W89-03160 5D
charge of Aquifers in the	Los Angeles Area,	New Jersey Inner Shelf,	NEWSON, M. D.
California, W89-02335	7A	W89-03187 2J	Transport Processes at the Catchment Scale
W 87-02333	/A	NACATA T	W89-02437 2
MUIRHEAD-THOMSON, R	t. C.	NAGATA, T.	
Pesticide Impact on Stream		Microflagellate-Picoplankton Food Linkage in the Water Column of Lake Biwa,	NICHOLS, M. M.
Reference to Macroinverte		W89-03245 2H	Consequences of Dredging,
W89-02773	5C	W 07-03243 211	W89-02700 21
MUJERIEGO, R.		NAGEL, R.	NICOLICH, M. J.
Pretreatment for Wastewa	ater Reclamation and	Use of Well Packers To Control TCE and PCE	Sediment Transport from Delaware Bay to the
Reuse.		Contaminants,	New Jersey Inner Shelf,
W89-02820	5D	W89-02356 5G	W89-03187 2
MIII DED. I		NAGUIT, R. S. J.	
MULDER, J. Differences in Aluminum M	Mobilization in Snode	Application of Statistical Process Control to	NIELSEN, P. H.
sols in New Hampshire (U		Wastewater Pretreatment,	Hydrogen Sulphide Control in Municipa
erlands as a Result of Acid		W89-02404 5D	Sewers,
W89-02309	5B		W89-02810 5I
		NAIDU, B. S. K.	NIGG, H. N.
MULLER, M.		Updating and Refurbishing Hydro Plants in India,	Diflubenzuron Application to Citrus and It
Determination of Metals w		W89-03155 8C	Impact on Invertebrates in an Adjacent Pond
parison to the AAS, Phot		W 67-03133	W89-03208 56
Balance of the Anions (I mit der ICP-AES im Ver		NAKAHARA, H.	NIPPEI M
tometrie und Anionen-Mill		Volatilization of Mercury Compounds by Meth-	NIKKEL, M. Assessment of the Adequacy of the Ground
W89-03048	5A	ylmercury-Volatilizing Bacteria in Minamata	Water Monitoring System for Artificial Re
	•••	Bay Sediment,	charge of Aquifers in the Los Angeles Are
MUNEMORI, M.		W89-03197 5B	California,
Continuous Flow Determ		NAKAMURA, K.	W89-02335 7/
oxide in Water by Membra	ane Separation-Chemi-	Volatilization of Mercury Compounds by Meth-	
luminescent Detection, W89-03182	7B	ylmercury-Volatilizing Bacteria in Minamata	NIR, A.
W 87-03182	7.0	Bay Sediment,	Role of Tracer Methods in Hydrology as
MUNGER, R. S.		W89-03197 5B	Source of Physical Information: Basic Concept
Long-Term Sublethal Ac		NIABITITY T THE	and Definitions, Time Relationship in Dynami Systems,
bow Trout (Salmo gaire		NANEY, J. W. Nitrogen and Ground Water Protection.	W89-03010 7.
Effects on Ion Exchanges		W89-02679 5G	
W89-03226	5C	***************************************	NIXON, S. W.
MUNKITTRICK, K. R.		Saline Seep on Wheatland in Northwest Oklaho-	Physical Energy Inputs and the Comparative
Growth, Fecundity, and E	Energy Stores of White	ma,	Ecology of Lake and Marine Ecosystems,
Sucker (Catostomus com		W89-02672 5B	W89-03272 2
Containing Elevated Leve		NATKANSKI, J.	NOBEN, N. N.
W89-03225	5C	Recent Acidification of a Large Scottish Loch	Quantitative Studies of Biodegradation of Petro
MUNSON, R.		Located Partly within a National Nature Re-	leum And Some Model Hydrocarbons
Sensitivity of Meander La	ke to Acid Deposition.	serve and Site of Special Scientific Interest,	Ground Water and Sediment Environments,
W89-03110	5C	W89-03125 5C	W89-02674
MURPHY, T. J.		NEBEKER, A. V.	NOFZIGER, D. L.
Design of a Great Lake	es Atmospheric Inpute	Chronic Effects of Contaminated Sediment on	Interactive Simulation of Chemical Moveme
and Sources (GLAIS) Ne		Daphnia magna and Chironomus tentans,	in Soil,
W89-02418	7A	W89-03312 5C	W89-02675
		AIDCUTE AI	NOU II
Preliminary Environmen Contamination Associate		NEGUT, N. Sources of Sediment and Channel Changes in	NOH, H. Separators and Emulsion Separation Systems f
Cook County, Illinois,	with Lanc Carumet,	Small Catchments of Romania's Hilly Regions,	Petroleum, Oil, and Lubricants.
W89-02870	5B	W89-02896 2J	W89-02808 5

5D

NORRIS, J. M. Surface Water Quality Characteristics in the Upper North Fork Gunnison River Basin, Colo-	Ecological Research on South African Rivers - A Preliminary Synthesis, W89-02982 2H	OPATKEN, E. J. Stringfellow Leachate Treatment with RBC, W89-03328 5D
rado, W89-02593 5B	O'MELIA, C. R. From Filters to Forests: Water Treatment and	ORAJAKA, I. P.
NORTCLIFF, S. Floodplain Response of a Small Tropical	Supply, W89-02792 5F	Groundwater Occurrence and Flow Pattern in the Enugu Coal-Mine Area, Anambra State, Ni- geria,
Stream, W89-02885 2E	O'NEIL, T. A. Cumulative Impact Assessment: Application of a	W89-03051 2F
NORTON, S. A. Comparison of Lake Sediments and Ombrotro- phic Peat Deposits as Long-Term Monitors of	Methodology, W89-02824 7C	OSANTOWSKI, R. A. Evaluation of Biological Treatment of Pharmaceutical Wastewater with PAC Addition. Volume I.
Atmospheric Pollution, W89-02321 5A	Groundwater Levels in Wyoming, 1976 Through 1985,	W89-02948 5D
Stratigraphic Record of Atmospheric Loading of Metals at the Ombrotrophic Big Heath Bog,	W89-02525 7C OBERG, K. A. Estimating Generalized Skew of the Log-Pear-	Evaluation of Biological Treatment of Pharma- ceutical Wastewater with PAC Addition.
Mt. Desert Island, Maine, U.S.A., W89-02315 5B	son Type III Distribution for Annual Peak Floods in Illinois,	Volume II - Appendices, W89-02949 5D
NOVELLI, P. Hydrogen (H2) Distributions in the Carmans	W89-03006 2E	OSTERKAMP, W. R.
River Estuary, W89-03194 2L	OBEROI, B. R. Updating and Refurbishing Hydro Plants in India,	Dendrogeomorphic Evidence and Dating of Recent Debris Flows on Mount Shasta, North- ern California,
NOWLIN, J. O. Documentation for a Digital Computer Model	W89-03155 8C	W89-03028 2J
of Nutrient and Dissolved-Oxygen Transport in the Truckee River and Truckee Canal Down- stream from Reno, Nevada,	OBST, U. Biochemical Testing of Groundwater, W89-03085 5A	Magnitude and Frequency of Debris Flows, and Areas of Hazard on Mount Shasta, Northern California,
W89-02504 5B	ODEGAARD, H.	W89-03029 2J
NOYES, T. I. Effects of Organic Wastes from Processing of Green River Formation Oil Shale on Water	Humic Substances Removal by Alum Coagula- tion: Direct Filtration at Low pH, W89-02795 5F	OTLET, R. L. Stable Isotopes: An Investigation into Their Application in Karst Hydrology in the U.K., with
Quality, W89-02487 5B	ODEGARRD, H. Coagulation as the First Step in Wastewater Treatment,	Special Reference to the Malham Area, North Yorkshire, W89-02734 2F
NURNBERG, G. K. Prediction of Phosphorus Release Rates from	W89-02811 5D	PACKARD, K. B.
Total and Reductant-Soluble Phosphorus in Anoxic Lake Sediments, W89-03210 2H	OGLIARUSO, M. A. Dye-Sensitized Photochemical Reduction of PCBs,	Chlorine Sensitivity of Early Life Stages of Freshwater Fish,
NWANKWOR, G. L.	W89-03101 5D	W89-03333 5C
Groundwater Occurrence and Flow Pattern in the Enugu Coal-Mine Area, Anambra State, Ni- geria,	OHMAN, L. O. Thermodynamic Calculations with Special Reference to the Aqueous Aluminum System,	PADDA, D. S. Fiscal Year 1986 Program Report (Virgin Islands Water Resources Research Center),
W89-03051 2F	W89-02641 2K	W89-02588 9D
NYSTROM, J. M. Engineering/Cost Evaluation of Options for Removal/Disposal of NC Fines, W89-02933 5D	OKUDA, S. Some Relationships Between Debris Flow Motion and Micro-Topography for the Kamika- mihori Fan, North Japan Alps, W89-02907 2J	PADGITT, S. Assessing Some Potentials for Changing Agro- nomic Practices and Improving Ground Water Quality: Implications from a 1984 Iowa Survey W89-02669 5G
O'BRIEN, J. S. Case Study of Minimum Streamflow for Fishery Habitat in the Yampa River, W89-02460 2J O'BRYAN, G. K.	OLDENSTEIN, K. Treatment of Filter Effluents from Dewatering of Sludges by a New High Performance Flocculation Reactor, W89-02819 5D	PAERL, H. W. Effects of the Blue-Green Alga Microcystis Aer uginosa on Zooplankton Competitive Relations W89-03118 21:
Limnological and Fishery Studies on Lake	OLIVER, R. H. P.	Nuisance Phytoplankton Blooms in Coastal, Es
Sharpe, a Main-stem Missouri River Reservoir, 1964-1975, W89-02423 2H	Appendicitis Epidemic Following Introduction of Piped Water to Anglesey, W89-03041 5F	tuarine, and İnland Waters, W89-03262 2F
Zooplankton Biomass Exchange in Lake Sharpe, South Dakota, 1974-1975, W89-02425 2H	OLSEN, A. R. Acid Precipitation in North America: 1985 Annual and Seasonal Data Summaries from	PAGE, G. W. Water System Responses to Toxic Contamina tion of Groundwater Supplies,
O'CONNOR, G. A. Predicting Chemical Movement in Soils, W89-02473 5B	Acid Deposition System Data Base, W89-02997 5B	W89-02586 51 PAGE, R. W.
W89-02473 5B O'CONNOR, J. S. Monitoring, Research, and Management: Inte-	OLSEN, R. D. Cumulative Impact Assessment: Issues to Consider in Selecting a Cumulative Assessment	Geology of the Fresh Ground-Water Basin of the Central Valley, California, with Textur Maps and Sections,
gration for Decisionmaking in Coastal Marine Environments,	Method, W89-02965 5C	W89-03032 21 PAILY, K. P.
W89-02323 5A	OLSEN, Y. Growth and Phosphorous Status of Limnetic	Engineering, Mosquitoes and Filariasis: A Cas Report,
O'KEEFFE, J. H. Conservation Aims, Criteria, and Goals for Rivers,	Phytoplankton and Bacteria, W89-03244 2H	W89-03065 50
W89-02987 2H Conservation of South African Rivers,	ONJUKKA, S. T. Chronic Effects of Contaminated Sediment on Daphnia magna and Chironomus tentans,	PALMER, M. Bacterial Loadings from Resuspended Sediment in Recreational Beaches,
W89-02985 2H		W89-03136 51

PALOC, H. Report on Hudrogeological Mans of Varieties	PATRICK, W. H.	PEZESHKI, S. R.
Report on Hydrogeological Maps of Karstic Terrains,	Response of Coastal Plants to Increase in Sub- mergence and Salinity,	Response of Coastal Plants to Increase in Sub-
W89-02389 2F	W89-03188 2L	mergence and Salinity, W89-03188 2L
PANICONI, C.	PATTERSON, J. W.	
Model Calibration Based on Random Environ-	Metal Treatment and Recovery,	PHELPS, D. K.
mental Fluctuations,	W89-02653 5D	Coastal Monitoring: Evaluation of Monitoring
W89-03105 7A		Methods in Narragansett Bay, Long Island
PANKRATZ, T. M.	PAULSON, R. L.	Sound and New York Bight, and a General
Treatment of Process Wastewater from Petro-	Toxicity of DEGDN, Synthetic-HC Smoke	Monitoring Strategy,
chemical Plant Using a Rotating Biological Con-	Combustion Products, Solvent Yellow 33 and	W89-02325 5A
tactor - A Case Study,	Solvent Green 3 to Freshwater Aquatic Orga-	'Mussel Watch'Measurements of Chemical Pol-
W89-02292 5D	nisms, . W89-02936 5C	lutants in Bivalves as One Indicator of Coastal
DADANIDE W W	, 1107-02730	Environmental Quality,
PARANJPE, V. V. Uprating of Four Indian Hydro Plants,	PAULSRUD, B.	W89-02326 5A
W89-03157 8C	Pretreatment of Sludge Liquors in Sewage	
	Treatment Plants,	PHILIPPACOPOULOS, A. J.
PARK, E. T.	W89-02817 5D	Influence of Ground Water on Soil-Structure
Hydrologic Design Methodologies for Prefeasi-	PAYNE, B, R,	Interaction,
bility Studies of Small-Scale Hydro at Ungauged	Use of Linear Compartmental Simulation Ap-	W89-02850 2F
Sites, W89-03129 7A	proach for Quantitative Interpretation of Isotope	
W 69-03129	Data under Time Variant Flow Conditions,	PHILLIPS, D. J. H.
PARK, J. E.	W89-03017 7C	Strategies for Long-Term Pollution Monitoring
Treatment of Aqueous Metal Bearing Hazardous	DESIREMENT OF	of the Coastal Oceans,
Wastes,	PEITCHEV, T.	W89-02319 5A
W89-02396 5D	Biotechnology for Manganese Removal from Groundwater,	PICKENS, W. E.
PARK, K. S.	W89-03093 5F	
Biological Transformation and Detoxification of	W 87-03073	In-Situ Hydrocarbon Extraction, A Case Study, W89-02354 5G
7,12-Dimethylbenz(a)anthracene in Soil Systems,	PELLETIER, P. A.	W89-02354 5G
W89-03161 5B	Concentration of Mycobacterium avium by Hos-	PICKLES, A. M.
DARK M. T.	pital Hot Water Systems,	Hydrology and Solute Uptake in Hillslope Soils
PARK, MJ. Sediment Transport Prediction in a Tidal Inlet	W89-03304 5B	on Magnesian Limestone: the Whitwell Wood
Using a Numerical Model: Application to Stony	PENNING-ROWSELL, E. C.	Project,
Brook Harbor, Long Island, New York, USA,	Power Behind the Flood Scene,	W89-02891 2G
W89-03185 2J	W89-02747 6E	
		PICKUP, G.
PARKER, D. J.	PEQUEGNAT, J. E.	Estimating the Transport and Deposition of
Flood Warning Dissemination: The British Ex-	Cycling of Methane, Carbon Monoxide, Nitrous	Mining Waste at Ok Tedi,
perience, W89-02753 6F	Oxide, and Hydroxylamine in a Meromictic,	W89-02461 21
W89-02753 6F	Coastal Lagoon,	
Institutional and Policy Context,	W89-03191 2L	PINAY, G.
W89-02745 6F	PERDUE, E. M.	Attempt to Facilitate Water Management Issue
PARKER, G.	Measurements of Binding Site Concentrations in	in the Zambezi River Basin Using Decision Sup
Formation of a Coarse Surface Layer as the	Humic Substances,	port Systems,
Response to Gravel Mobility,	W89-02647 7B	W89-03145 50
W89-02440 2J	DEDDET D	Role of Riparian Woods in Regulating Nitroger
	PERRET, D. Combining Field Measurements for Speciation	Fluxes Between the Alluvial Aquifer and Sur
PARKER, R. S.	in Non Perturbable Water Samples: Application	face Water: A Conceptual Model,
Calibration of a Dissolved-Solids Model for the	to the Iron and Sulfide Cycles in a Eutrophic	W89-03140 6C
Yampa River Basin Between Steamboat Springs	Lake,	1107 03110
and Maybell, Northwestern Colorado, W89-02591 5B	W89-02645 5B	PINTO, O.
W 65-02591		Effect of Activated Sludge in the Breeder Die
Methods for Hydrologic Monitoring of Surface	PERRY, C. M.	on the Reproduction Criteria and the Perform
Mining in the Central-Western United States,	Toxicity of Six Heterocyclic Nitrogen Com-	ance of their Offspring,
W89-02490 7A	pounds to Daphnia pulex,	W89-03061 5I
PARLIMAN, D. J.	W89-03315 5C	
Quality of Ground Water in the Payette River	PERRY, J. A.	PITLICK, J. C.
Basin, Idaho,	Innovative Designs for Water Quality Monitor-	Sediment Supply, Movement and Storage in a
W89-03008 5G	ing: Are We Asking the Questions Before the	Unstable Gravel-Bed River,
	Data Are Collected,	W89-02436 2
Selected Water-Quality Data for the Murtaugh	W89-02320 7A	PITMAN, J. I.
Lake Area, South Central Idaho, June 1987,		Chemical Weathering of the East Yorkshir
W89-02530 7C	PETERSEN, G. W.	Chalk,
PARSONS, A. M.	Synoptic-Scale Assessment of Surface Runoff, W89-02703 2E	
Field Simulation of Waste Impoundment Seep-	W89-02703 2E	W89-02731 21
age in the Vadose Zone,	PETERSON, G. W.	PITTY, A. F.
W89-02348 5B	Hurricane-Induced Sediment Deposition in a	Karst Water Temperature and the Shaping of
PARTIN, K. J.	Gulf Coast Marsh,	Malham Cove, Yorkshire,
Modeling Acid Migration Through Soils,	W89-03193 2J	W89-02737 2
W89-02361 5B	DETTIT CHASE U	
	PETTIT-CHASE, H. Regulation of the Agricultural Utilization of	PLAFCAN, M.
PATE, D. L.		Groundwater Levels in the Alluvial Aquifer i
Hydrologic Data for Urban Studies in the	W89-02676 5E	Eastern Arkansas, 1986,
Austin Metropolitan Area, Texas, 1986, W89-02597 4C		W89-02522
1107-02371	PETTY, J. D.	DI APP D II
PATHAK, B. D.	Gas Chromatographic Residue Patterns of Toxa-	PLATT, R. H.
Groundwater Resources Development and Man-	phene in Fish Samples from the Great Lakes and	Flood Loss Reduction by Metropolitan Regions
agement in India,	from Rivers of the Southeastern United States,	Authorities in the United States,
W89-02373 2F	W89-02328 5B	W89-02752 6

6E

PLAYLE, R. C.

PLAYLE, R. C.	PRITCHARD, D. W.	RAJU, K. C. B.
Blood Gases, Acid-Base Status, Ions, and Hema- tology in Adult Brook Trout (Salvelinus fontina-	Oceanography of Chesapeake Bay, W89-02693 2L	Hydrogeological Problems of Hard Rock Areas of Southern India,
lis) Ünder Acid/Aluminum Exposure, W89-03236 5C	PROMINSKI, N.	W89-02374 2F
DOT W.	Corrective Measures for Releases to Ground-	RAKNESS, K. L.
POE, M. L. North Alabama Water Quality Assessment, Volume VIII - Water Quality Modeling,	water from Solid Waste Management Units, W89-02844 5G	Handbook: Improving POTW Performance Using the Composite Correction Program Ap-
W89-02702 5B	PRYCH, E. A.	proach,
	Quantity and Quality of Storm Runoff from	W89-02845 5D
POLAND, J. F. Land Subsidence in the San Joaquin Valley,	Three Urban Catchments in Bellevue, Washing-	RAMAMOORTHY, S.
California, as of 1980,	ton, W89-03000 5B	Effect of pH on Speciation and Toxicity of
W89-03018 6G	W 89-03000	Aluminum to Rainbow Trout (Salmo gairdneri),
Land Subsidence in the Santa Clara Valley, Cali-	PUGSLEY, C. W.	W89-03213 5C
fornia, as of 1982, W89-03019 6G	Distribution of Contaminants in Clams and Sedi- ments from the Huron-Erie Corridor: II. Lead	Organic Chemicals in Natural Waters: Applied
	and Cadmium,	Monitoring and Impact Assessment,
PONAT, A. Effects of Water Soluble Crude Oil Fractions on	W89-03177 5B	W89-02776 5C
Cirral Beat Frequency in Balanus balanoides,	QIU, X. F.	RANDALL, J. M.
W89-03205 5C	Dynamic Reservoir Interaction with Monticello	Freshwater and Marine Coupling in Estuaries of
POOLE T	Dam,	the Mississippi River Deltaic Plain,
POOLE, T. Sulfate Resistance of Mortars Made Using Port-	W89-02848 8A	W89-03271 2E
land Cement and Blends of Portland Cement and	QUAZI, M. E.	DANIEL LO
Pozzolan or Slag,	River Bed Scour and Construction of Stone	RANKL, J. G.
W89-02714 8F	Riprap Protection,	Hydrology of the White Tail Butte Area, North- ern Campbell County, Wyoming,
PORTER, K. S.	W89-02442 8A	W89-02596 4C
Fiscal Year 1986 Program Report (New York	QUIGLEY, M. A.	110702270
Water Resources Institute),	Operations for an Under-Ice Ecology Program,	RANZAU, C. E.
W89-02471 9D	W89-03179 2H	Groundwater Withdrawals and Changes in
PORTER, R. N.	Silica and Phosphorus Flux from Sediments: Im-	Groundwater Quality and Land Surface Subsid-
Conservation Management Options for Rivers,	portance of Internal Recycling in Lake Michi-	ence in the Houston District, Texas, W89-02519 6G
W89-02989 6A	gan,	W89-02319 0O
POSSIDENTO, M. C.	W89-03219 2H	Records of Wells, Drillers' Logs, Water Level
How Clean Is Clean. (What Constitutes the	QUINN, J. P.	Measurements, and Chemical Analyses of
Clean Closure of a Hazardous Waste Land Man-	Pilot Scale Results of Metal Value Recovery	Groundwater in Harris and Galveston Counties,
agement Facility), W89-02399 5E	from Mixed Metal Hydroxide Sludges,	Texas 1980-84, W89-02497 7C
W 65-02377	W89-02394 5D	W 89-02491
POTTER, D. M.	QUINONES, F.	RASMUSSEN, J. B.
Process Development and Treatment Plant Startup for an Explosives Industry Wastewater,	Water Resources Investigations in Tennessee:	Littoral Zoobenthic Biomass in Lakes, and Its
W89-02287 5D	Programs and Activities of the U.S. Geological	Relationship to Physical, Chemical, and Trophic
	Survey, 1987-1988, W89-02559 7C	Factors, W89-03229 2H
POTTS, G. W. Fish (Survey of),	W 65-02337	W 67-03227
W89-02771 7B	Water Resources Investigations in Tennessee:	RASMUSSEN, L. A.
DRACAD M. C	Programs and Activities of the U.S. Geological	Bed Topography Inferred From Airborne
PRASAD, M. S. Sensitivity of Branchial Mucus to Crude Oil	Survey, 1987-1988, W89-02570 9C	Radio-Echo Sounding of Columbia Glacier,
Toxicity in a Freshwater Fish, Colisa fasciatus,	W 03-02310	Alaska, W89-03022 2C
W89-03204 5C	QUIRIJNS, J. K.	W 69-03022
PRATER, A. J.	Capillary Gas Chromatographic Determination	Surface Topography of the Lower Part of Co-
Birds,	of Amitrole in Water with Alkali Flame Ioniza- tion Detection.	lumbia Glacier, Alaska, 1974-81,
W89-02772 2L	W89-03287 5A	W89-03021 2C
PREPAS, E. E.		RAUBER, R. M.
Comparison of In Situ Estimates of Chlorophyll	RADOANE, N. Landsliding, Slope Development and Sediment	Diagnostic Technique for Targeting during Air-
a Obtained with Whatman GF/F and GF/C	Yield in a Temperate Environment: Northeast	borne Seeding Experiments in Wintertime
Glass-Fiber Filters in Mesotrophic to Hypereu-	Romania,	Storms over the Sierra Nevada,
tophic Lakes, W89-03217 7B	W89-02897 2J	W89-03305 2B
	RAGHAVA RAO, S. V.	RAWLINSON, C.
PRESS, M. C.		Trace Metal Transport in a Tropical Estuary,
Responses to Acidic Deposition in Ombotrophic		
	Groundwater Flow through a Miliolite Lime- stone Aquifer,	W89-03276 2L
Mires in the U.K., W89-02314 5B	Groundwater Flow through a Miliolite Lime-	W89-03276 2L
W89-02314 5B	Groundwater Flow through a Miliolite Lime- stone Aquifer, W89-03050 2F	W89-03276 2L RAYNAL, D. J.
W89-02314 5B PRESTON, S. D.	Groundwater Flow through a Miliolite Lime- stone Aquifer,	W89-03276 2L RAYNAL, D. J. Effects of Simulated Acid Rain on Sugar Maple
W89-02314 5B PRESTON, S. D. Development of Estimation Methods for Tribu-	Groundwater Flow through a Miliolite Lime- stone Aquifer, W89-03050 2F RAIKOS, N. Comparative Study of Different Techniques for Nitrate Determination in Environmental Water	W89-03276 2L RAYNAL, D. J. Effects of Simulated Acid Rain on Sugar Maple Seedling Roct Growth,
W89-02314 5B PRESTON, S. D.	Groundwater Flow through a Miliolite Lime- stone Aquifer, W89-03050 2F RAIKOS, N. Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples,	W89-03276 2L RAYNAL, D. J. Effects of Simulated Acid Rain on Sugar Maple Seedling Root Growth, W89-03300 5C
W89-02314 5B PRESTON, S. D. Development of Estimation Methods for Tributary Loading Rates of Toxic Chemicals, W89-02547 5B	Groundwater Flow through a Miliolite Lime- stone Aquifer, W89-03050 2F RAIKOS, N. Comparative Study of Different Techniques for Nitrate Determination in Environmental Water	W89-03276 2L RAYNAL, D. J. Effects of Simulated Acid Rain on Sugar Maple Seedling Roct Growth, W89-03300 5C REAY, P. J.
W89-02314 5B PRESTON, S. D. Development of Estimation Methods for Tributary Loading Rates of Toxic Chemicals,	Groundwater Flow through a Miliolite Lime- stone Aquifer, W89-03050 2F RAIKOS, N. Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples,	W89-03276 2L RAYNAL, D. J. Effects of Simulated Acid Rain on Sugar Maple Seedling Root Growth, W89-03300 5C REAY, P. J. Fish (Survey of),
W89-02314 5B PRESTON, S. D. Development of Estimation Methods for Tributary Loading Rates of Toxic Chemicals, W89-02547 5B PRICE, R. E.	Groundwater Flow through a Miliolite Lime- stone Aquifer, W89-03050 2F RAIKOS, N. Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A RAINWATER, K. Quantity and Quality of Recharge to the Ogal-	W89-03276 2L RAYNAL, D. J. Effects of Simulated Acid Rain on Sugar Maple Seedling Roct Growth, W89-03300 5C REAY, P. J.
W89-02314 PRESTON, S. D. Development of Estimation Methods for Tributary Loading Rates of Toxic Chemicals, W89-02547 PRICE, R. E. Temperature Analysis, Howard A. Hanson Reservoir, Washington: Mathematical Model Investigation,	Groundwater Flow through a Miliolite Lime- stone Aquifer, W89-03050 2F RAIKOS, N. Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A RAINWATER, K. Quantity and Quality of Recharge to the Ogal- lala Aquifer from Urban Runoff,	W89-03276 2L RAYNAL, D. J. Effects of Simulated Acid Rain on Sugar Maple Seedling Root Growth, W89-03300 5C REAY, P. J. Fish (Survey of), W89-02771 7B
W89-02314 5B PRESTON, S. D. Development of Estimation Methods for Tributary Loading Rates of Toxic Chemicals, W89-02547 5B PRICE, R. E. Temperature Analysis, Howard A. Hanson Reservoir, Washington: Mathematical Model Inveseroir, Washington:	Groundwater Flow through a Miliolite Lime- stone Aquifer, W89-03050 2F RAIKOS, N. Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A RAINWATER, K. Quantity and Quality of Recharge to the Ogal-	W89-03276 2L RAYNAL, D. J. Effects of Simulated Acid Rain on Sugar Maple Seedling Root Growth, W89-03300 5C REAY, P. J. Fish (Survey of),
W89-02314 PRESTON, S. D. Development of Estimation Methods for Tributary Loading Rates of Toxic Chemicals, W89-02547 PRICE, R. E. Temperature Analysis, Howard A. Hanson Reservoir, Washington: Mathematical Model Investigation, W89-02877 PRICKETT, T. A.	Groundwater Flow through a Miliolite Limestone Aquifer, W89-03050 2F RAIKOS, N. Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A RAINWATER, K. Quantity and Quality of Recharge to the Ogal- lala Aquifer from Urban Runoff, W89-02340 4C RAJAVEL, A. R.	W89-03276 RAYNAL, D. J. Effects of Simulated Acid Rain on Sugar Maple Seedling Root Growth, W89-03300 SC REAY, P. J. Fish (Survey of), W89-02771 TB RECHARD, P. Assessment of the Adequacy of the Ground-Water Monitoring System for Artificial Re-
W89-02314 PRESTON, S. D. Development of Estimation Methods for Tributary Loading Rates of Toxic Chemicals, W89-02547 PRICE, R. E. Temperature Analysis, Howard A. Hanson Reservoir, Washington: Mathematical Model Investigation, W89-02877 PRICKETT, T. A. Simulating Underground Mines in a Regional	Groundwater Flow through a Miliolite Limestone Aquifer, W89-03050 2F RAIKOS, N. Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A RAINWATER, K. Quantity and Quality of Recharge to the Ogallala Aquifer from Urban Runoff, W89-02340 4C RAJAVEL, A. R. Engineering, Mosquitoes and Filariasis: A Case	W89-03276 RAYNAL, D. J. Effects of Simulated Acid Rain on Sugar Maple Seedling Root Growth, W89-03300 5C REAY, P. J. Fish (Survey of), W89-02771 7B RECHARD, P. Assessment of the Adequacy of the Ground-Water Monitoring System for Artificial Recharge of Aquifers in the Los Angeles Area,
W89-02314 PRESTON, S. D. Development of Estimation Methods for Tributary Loading Rates of Toxic Chemicals, W89-02547 PRICE, R. E. Temperature Analysis, Howard A. Hanson Reservoir, Washington: Mathematical Model Investigation, W89-02877 PRICKETT, T. A.	Groundwater Flow through a Miliolite Limestone Aquifer, W89-03050 2F RAIKOS, N. Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples, W89-03302 5A RAINWATER, K. Quantity and Quality of Recharge to the Ogal- lala Aquifer from Urban Runoff, W89-02340 4C RAJAVEL, A. R. Engineering, Mosquitoes and Filariasis: A Case Report,	W89-03276 RAYNAL, D. J. Effects of Simulated Acid Rain on Sugar Maple Seedling Root Growth, W89-03300 5C REAY, P. J. Fish (Survey of), W89-02771 7B RECHARD, P. Assessment of the Adequacy of the Ground-

REDDING, M. B.	REUTER, J. M.	RISATTI, J. B.
Random Survey of VOC's, Pesticides and Inorganics in Arizona's Drinking Water Wells, W89-02344 5A	Polyelectrolytes for the Treatment of Tap and Filter Back Washing Water, W89-02797 5F	Preliminary Environmental Assessment of the Contamination Associated with Lake Calumet, Cook County, Illinois,
REDUKER, S.	REUTTER, J. M.	W89-02870 5B
Characteristics of the Sorption of Chlorothalonil	Role of the Seed Bank in the Development of	RISSMANN, E.
and Azinphos-Methyl to a Soil from a Commer-	Vegetation on a Freshwater Marsh Created	Waste Minimization Audit Report: Case Studies
cial Cranberry Bog, W89-03195 5B	from Dredge Spoil, W89-03169 2H	of Minimization of Mercury-Bearing Wastes at a Mercury Cell Chloralkali Plant,
REICH, P. B.	REYNOLDS, B.	W89-02821 5E
Effects of Ozone and Acid Rain on White Pine (Pinus strobus) Seedlings Grown in Five Soils:	Coastal Monitoring: Evaluation of Monitoring	RITTMANN, B. E.
II. Mycorrhizal Infection,	Methods in Narragansett Bay, Long Island Sound and New York Bight, and a General	Potential for Treatment of Hazardous Organic
W89-03057 5C	Monitoring Strategy, W89-02325 5A	Chemicals with Biological Processes, W89-02929 5D
Effects of Ozone and Acid Rain on White Pine (Pinus strobus) Seedlings Grown in Five Soils:		1107-02727
III. Nutrient Relations,	REYNOLDS, D. W. Diagnostic Technique for Targeting during Air-	ROBBINS, J. A.
W89-03058 5C	borne Seeding Experiments in Wintertime	Sediment Record of Biogeochemical Responses to Anthropogenic Perturbations of Nutrient
REICHMUTH, D. R.	Storms over the Sierra Nevada,	Cycles in Lake Ontario,
Effects of Geology, Runoff, and Land Use on	W89-03305 2B	W89-03222 2H
the Stability of the West Gallatin River System,	RHEA, J. O.	ROBERT, C.
Gallatin County, Montana, W89-02472 4C	Diagnostic Technique for Targeting during Air-	Sensitivity Analysis of Adsorption and Degrada-
	borne Seeding Experiments in Wintertime Storms over the Sierra Nevada,	tion Parameters in the Modeling of Pesticide
REIMERS, C. E. Methane Cycling in the Sediments of Lake	W89-03305 2B	Transport in Soils,
Washington,	RIBERIO, M. N. G.	W89-03150 2G
W89-03249 2H	Biogenic Gases and the Oxidation and Reduc-	ROBERTS, C. P. R.
REINERTSEN, H.	tion of Carbon in Amazon River and Floodplain	Conservation Management Options for Rivers
Growth and Phosphorous Status of Limnetic	Waters,	W89-02989 6A
Phytoplankton and Bacteria,	W89-03247 2E	DODERSC D D
W89-03244 2H	RICHARDS, D. J.	ROBERTS, P. D. Distribution of Gamma-emitting Radionuclide
REJMANEK, M.	Anoxic/Oxic Activated Sludge Treatment of	in Surface Subtidal Sediments Near the Sella
Hurricane-Induced Sediment Deposition in a	Cyanogens and Ammonia in the Presence of Phenols.	field Plant,
Gulf Coast Marsh, W89-03193 2J	W89-02298 5D	W89-03190 51
	RICHARDS, D. R.	ROBERTS, P. J. W.
RENARD, D. E. Land Treatment of Nitroguanidine Wastewater,	New Haven Harbor Numerical Model Study,	Ocean Outfall System for Dense and Buoyan
W89-02293 5D	W89-02874 6G	Effluents, W89-03108
Plating Waste Sludge Metal Recovery,	RICHEY, J. E.	W89-03108 5E
W89-02395 5D	Biogenic Gases and the Oxidation and Reduc-	ROBERTS, P. V.
REPETTO, G.	tion of Carbon in Amazon River and Floodplain Waters.	Simulations of Physical Nonequilibrium Solut
In Vivo and In Vitro Effect of Triclorfon on	W89-03247 2E	Transport Models: Application to a Large-Scal Field Experiment,
Esterases of the Red Crayfish Procambarus clar- kii,	RIED, M.	W89-03148 21
W89-03314 5C	Heavy Metal Removal from Sewage Sludge:	
REPETTO, M.	Practical Experiences with Acid Treatment,	ROBERTS, R. S.
In Vivo and In Vitro Effect of Triclorfon on	W89-02818 5D	Selected Hydrogeologic Data for the Southwei Glendive Preliminary Logical Mining Unit an
Esterases of the Red Crayfish Procambarus clar-	RIFAI, H. S.	Adjacent Areas, Dawson County, Montana,
kii, W89-03314 5C	Biodegradation Modeling at Aviation Fuel Spill	W89-02531 76
	Site, W89-03100 5G	ROBINSON, D. A.
RESCH, C. T. Influence of Cosolvents on Quinoline Sorption		Progression of Regional Snow Melt,
by Subsurface Materials and Clays,	RILEY, F. S. Land Subsidence in the San Joaquin Valley,	W89-02610 20
W89-03040 5B	California, as of 1980,	BOBINGON B B
RETAMAL, E.	W89-03018 6G	ROBINSON, R. B. Sequestration of Iron in Groundwater by Poly
Residual Strength of Sand From Dam Failures	RINGPFEIL, M.	phosphates,
in the Chilean Earthquake of March 3, 1985, W89-02851	Aerobic Treatment of Sewage from Lignite	W89-03109 5
	(Brown Coal) Processing,	ROBOCK, A.
RETROWSKI, Y.	W89-02915 5D	Comparison of Northern Hemisphere Snor
Vulnerability Study of the Aubergenville Aqui- fer,	RINNE, D.	Cover Data Sets,
W89-03077 5B	Determination of Metals with ICP-AES in Com- parison to the AAS, Photometry, and Millival-	W89-02619 7
RETTMAN, P. L.	Balance of the Anions (Die Metallbestimmung	Effects of Snow Cover and Tropical Forcing of
Groundwater Resources of Limestone County,	mit der ICP-AES im Vergleich zur AAS, Pho-	Mid-Latitude Monthly Mean Circulation,
Texas,	tometrie und Anionen-Millival-Bilanz),	W89-02625 2
W89-02583 2F	W89-03048 5A	RODDY, W. R.
REUSS, J. O.	RINZEMA, A.	Water Quality of Canyon Lake, Central Texa
Critique of Models for Freshwater and Soil Acidification,	Anaerobic Treatment of Sulfate-Containing Waste Water,	W89-02579 2
W89-02967 5B	W89-02930 5D	BOE C P
		ROE, S. F. Combined Fixed Biological Film Media an
REUST, V. Effects of Temperature, Salinity and Seagrass	RIPPEY, B. Recent Acidification of a Large Scottish Loch	Evaporative Cooling Media to Solidify Hazard
Species on the Uptake of Lead(II) from Sea-		ous Wastes for Encapsulation and Efficient Di
water by Excised Leaves,	serve and Site of Special Scientific Interest,	posal,
W89-03275 5B	W89-03125 5C	W89-02294 5

ROGALLA, F.

ROGALLA, F.	ROSS, P. E.	SAGAR, B. T. A.
Recent Advances in Magnetic Processes, W89-02961 5D	Preliminary Environmental Assessment of the Contamination Associated with Lake Calumet, Cook County, Illinois,	Vibration and Leakage of Weir Gates, W89-03073 8C
ROGALSKY, P.	W89-02870 5B	SAGER, M.
Use of Well Packers To Control TCE and PCE Contaminants, W89-02356 5G	ROSSMAN, L. A. Computer Aided Design of Diffused Aeration	Determination of Traces of Thallium in Various Matrices,
1100 0000	Systems,	W89-03067
ROGGATZ, H. Chemically Supported Oil and Grease Removal	W89-02947 5D	SAHOO, D.
in Municipal Wastewater Treatment Plants, W89-02813 5D	ROWE, L. K. Rapid Subsurface Flow and Streamflow Solute Losses in a Mixed Evergreen Forest, New Zea-	Processes, Coefficients, and Models for Simulat- ing Toxic Organics and Heavy Metals in Surface Waters,
ROGGE, M.	land,	W89-02788 5B
Determination of Metals with ICP-AES in Com- parison to the AAS, Photometry, and Millival-	W89-02890 2G	SAKAR, A.
Balance of the Anions (Die Metallbestimmung mit der ICP-AES im Vergleich zur AAS, Pho-	ROYBAL, F. E. Hydrology of Area 62, Northern Great Plains	DDT Residues in Sediments from the Bay of Bengal,
tometrie und Anionen-Millival-Bilanz),	and Rocky Mountain Coal Provinces-New Mexico and Arizona,	W89-03198 5B
W89-03048 5A	W89-02498 2F	SAKATA, T.
ROHM, C. M. Ohio Stream Regionalization Project: A Com-	ROZANSKI, K. Deuterium Isotope Composition of Palaeoinfil-	Volatilization of Mercury Compounds by Meth- ylmercury-Volatilizing Bacteria in Minamata
pendium of Results, W89-02932 2H	tration Waters Trapped in Speleothems, W89-02981 5A	Bay Sediment, W89-03197 5B
ROMERO, L. I.	ROZZI, A.	SALAZAR, M. H.
Thermophilic Anaerobic Digestion of Winery Waste (Vinasses): Kinetics and Process Optimi-	Influence of Na and Ca Alkalinity on UASB Treatment of Olive Mill Effluents: I. Preliminary	Portable Environment Test System: A Field As-
vaste (vinasses): Kinetics and Process Optimization,	Results,	sessment of Organotin Leachates. Test and Eval-
W89-03114 5D	W89-03116 5D	uation, W89-03324 5C
ROMIJN, E.	RULKENS, W. H.	
Hydrogeological Mapping in Coastal Areas,	Literature Study on the Feasibility of Microbio- logical Decontamination of Polluted Soils,	SALAZAR, S. M.
W89-02390 2F Hydrogeological Maps from the View-Point of	W89-02916 5G	Portable Environment Test System: A Field As- sessment of Organotin Leachates. Test and Eval- uation,
the User,	RUSH, F. E. Reconnaissance of the Hydrothermal Resources	W89-03324 5C
W89-02391 7A	of Utah,	CATEC D
ROMM, E. D.	W89-03020 2F	SALES, D. Thermophilic Anaerobic Digestion of Winery
Enhanced Secondary Treatment Incorporating Biological Nutrient Removal,	RUSHTON, K. R. Groundwater Flow through a Miliolite Lime-	Waste (Vinasses): Kinetics and Process Optimi-
W89-03163 5D	stone Aquifer,	zation, W89-03114 5D
RONEN, D.	W89-03050 2F	
Contaminated Aquifers are a Forgotten Compo-	RUSSELL, W. B.	SALEWICZ, K. A. Attempt to Facilitate Water Management Issues
nent of the Global N2O Budget, W89-03121 5B	River Conservation - Implications for Legisla-	in the Zambezi River Basin Using Decision Sup- port Systems,
Groundwater Contamination by Nitrates and	W89-02992 6E	W89-03145 5G
Chlorides Washed out from Phosphorite Ores in the Negev Desert, Israel,	RUSSOM, C. L. Acute Toxicity and Behavioral Effects of Acry-	SALOMON, J. C.
W89-03147 5B	lates and Methacrylates to Juvenile Fathead	Oceanographic Characteristics of the Seine Es-
ROPELEWSKI, C. F.	Minnows, W89-03313 5C	tuary,
Snow Cover in Real Time Monitoring,	RUSTEN, B.	W89-02699 2L
W89-02615 2C	Pretreatment of Sludge Liquors in Sewage	SAMANIDOU, V.
ROSE, L. Alkalinity Measurements in Karst Water Stud-	Treatment Plants,	Comparative Study of Different Techniques for Nitrate Determination in Environmental Water
ies,		Samples,
W89-02729 2F	RUTH, H. Gastrointestinal Absorption of Soluble Uranium	W89-03302 5A
Kamenitzas of Gait Barrows National Nature	from Drinking Water,	Photodecomposition of Chlorophenols in Aque
Reserve, North Lancashire, England,	W89-02957 5B	ous Medium in Presence of Hydrogen Peroxide W89-03200 51
W89-02741 2F	RUILEDGE, S. A.	
ROSENBERG, M. L. Factors in Assessing the Compatibility of FMLs		SAMARA, C.
and Waste Liquids, W89-02952 5E	ture and Single-Doppler Radar Analysis,	Nitrate Determination in Environmental Water
ROSENTHAL, K.	RYBICKI, N. B.	W89-03302 5A
Groundwater Contamination by Nitrates and	Data on the Distribution and Abundance of Sub-	
Chlorides Washed out from Phosphorite Ores in		
the Negev Desert, Israel, W89-03147	the District of Columbia, 1986,	tions,
	W 89-02511	W89-03331 20
ROSS, B. Snow Cover, Cyclogenesis and Cyclone Trajec	RYDER, R. A. Applicability of Fish Yield Indices in Freshwa-	SAMPLE, G. A.
tories,	ter and Marine Ecosystems.	Saline Seep on Wheatland in Northwest Oklaho ma.
W89-02607 20	W89-03270 2H	W89-02672 5.
ROSS, D. D.	SADALGEKAR, V. V.	
Effects of Heavy Metal Pollution on Epilithi Bacteria,	 Evaluation of Sludge Settleability be Floc Characteristics, 	Groundwater Resources of Rusk County, Texa
11100 00000	3 33100 02469	77100 00404

Distribution Pattern and Reduction of Polychlo-	Flow Simulation Model of the Tidal Potomac	Project Appraisal, Resource Allocation and
rinated Biphenyls (PCB) in Bluefish Pomatomus saltatrix (Linnaeus) Fillets through Adipose	River, W89-02529 2L	Public Involvement, W89-02758 6E
Tissue Removal, W89-03199 5B	SCHALLA, R. Rationale for the Design of Monitoring Well	SCHMITT, F.
SANDERSON, J. A.	Screens and Filter Packs,	Influence of Sludge from Chemical Biological Wastewater Treatment on Nitrification and Di-
Fate of COD in an Anaerobic System Treating	W89-03332 5B	gestion,
High Sulphate Bearing Wastewater,	SCHAUL, G. M.	W89-02816 5D
W89-02295 5D	Biological Wastewater Treatment of Azo Dyes,	SCHNEIDER, M. L.
SANTHANAM, N. R.	W89-03327 5D	Temperature Analysis, Howard A. Hanson Res-
Uprating of Four Indian Hydro Plants, W89-03157 8C	SCHEERER, HP. Chemical Treatment of Flue Gas Washing Liq-	ervoir, Washington: Mathematical Model Inves- tigation,
SANTSCHI, P. H.	uids, W89-02809 5D	W89-02877 2H
Factors Controlling the Biogeochemical Cycles		SCHNEIDER, R. L.
of Trace Elements in Fresh and Coastal Marine Waters as Revealed by Artificial Radioisotopes, W89-03263 2H	SCHEITLIN, E. E. Use of Remote Gauging to Measure Sewer Invert Elevations and Head Loss,	Hydrochory and Regeneration in a Bald Cy- press-Water Tupelo Swamp Forest,
	W89-03280 5D	W89-03295 2H
SANZ, P. In Vivo and In Vitro Effect of Triclorfon on	SCHELSKE, C. L.	SCHNEIDER, V. R.
Esterases of the Red Crayfish Procambarus clar-	Sediment Record of Biogeochemical Responses	Roughness Coefficients for Densely Vegetated
kii,	to Anthropogenic Perturbations of Nutrient	Flood Plains, W89-02502 2E
W89-03314 5C	Cycles in Lake Ontario, W89-03222 2H	
SASSER, C. E.		SCHNEIDER, W. Water Analysis: A Practical Guide to Physico-
Hurricane-Induced Sediment Deposition in a	Silica and Phosphorus Flux from Sediments: Im- portance of Internal Recycling in Lake Michi-	Chemical, Chemical and Microbiological Water
Gulf Coast Marsh, W89-03193 2J	gan,	Examination and Quality Assurance,
	W89-03219 2H	W89-02777 7B
SATO, C. Processes, Coefficients, and Models for Simulat-	SCHENCK, R. C.	SCHNOOR, J. L.
ing Toxic Organics and Heavy Metals in Surface	Effect of pH on Iron and Manganese Uptake by	Predicting the Effects of a Pesticide Release to
Waters,	a Green Alga, W89-03246 5C	the Rhine River, W89-03159 5C
W89-02788 5B		
SAUER, B. A. Microcomputer Program Development for On-	SCHICK, A. P. Bed Load Transport in Desert Floods: Observa-	Processes, Coefficients, and Models for Simulat- ing Toxic Organics and Heavy Metals in Surface
Farm Irrigation Systems Planning,	tions in the Negev, W89-02450 2J	Waters, W89-02788 5B
W89-02550 6A	SCHINDLER, D. W.	
SAUNDERS, W. P.	Sources of Alkalinity in Precambrian Shield Wa-	SCHOETTLE, A. W. Effects of Ozone and Acid Rain on White Pine
Maryland Synoptic Stream Chemistry Survey: Estimating the Number and Distribution of	tersheds Under Natural Conditions and After Fire or Acidification,	(Pinus strobus) Seedlings Grown in Five Soils: II. Mycorrhizal Infection,
Streams Affected By or At Risk from Acidifica- tion,	W89-02313 2G	W89-03057 5C
W89-02846 5B	SCHLEEN, L. P.	Effects of Ozone and Acid Rain on White Pine
SAVENHED, R.	Photodegradation of the Lampricide 3-Trifluor- omethyl-4-nitrophenol (TFM): 2. Field Confir-	(Pinus strobus) Seedlings Grown in Five Soils:
Odour Control by Artificial Groundwater Re- charge,	mation of Direct Photolysis and Persistence of Formulation Impurities in a Stream During	III. Nutrient Relations, W89-03058 5C
W89-02799 5F	Treatment,	SCHRIMPF, W.
SAW, C. B.	W89-03175 5B	Contribution to Computation of Sedimentation
Fate of COD in an Anaerobic System Treating High Sulphate Bearing Wastewater,	SCHLESINGER, M. E. CO2-Induced Changes in Seasonal Snow Cover	of Solids in Horizontal-Sedimentation basins (Ein Beitrag zur Berechnung der Sedimentation
W89-02295 5D	Simulated by the OSU Coupled Atmospheric-	von Feststoffen in Horizontal Durchstromten Sandfangen),
SAXENA, S. K.	Ocean General Circulation Model, W89-02629 2C	W89-02711 5D
Movement of Carbofuran (Nematicide) in Soil		SCHRODER, L. J.
Columns, W89-03297 5B	SCHMAUSSER, G. Rubber Seals for Steel Hydraulic Gates,	External Quality-Assurance Results for the Na-
	W89-03074 8G	tional Atmospheric Deposition Program and Na-
SCAVIA, D. Dynamics of Lake Michigan Phytoplankton: Re-	SCHMIDT, A. R.	tional Trends Network During 1986, W89-02463 7C
lationship to Nitrogen and Silica Fluxes,	Assessment of Water Quality and Factors Af-	
W89-03230 2H	fecting Dissolved Oxygen in the Sangamon River, Decatur to Riverton, Illinois, Summer	Results of Intercomparison Studies for the Meas-
SCHAEFER, D. H.	1982,	urements of pH and Specific Conductance at National Atmospheric Deposition Program/Na-
Geophysical Logs and Hydrological Data for	W89-02486 5B	tional Trends Network Monitoring Sites, Octo-
Eight Wells in the Coyote Spring Valley Area,	Data-Collection Methods and Data Summary	ber 1981-October 1985,
Clark and Lincoln Counties, Nevada, W89-02603 4B	for the Assessment of Water Quality in Cedar	W89-02485 5A
	Creek, West-Central Illinois, W89-02520 7B	SCHROEDER, E. E.
SCHAEFER, F. L. Selected Literature on Water Resources Investi-		Floods in Central Texas, August 1-4, 1978, W89-03025 2E
gations in New Jersey by the U.S. Geological	SCHMIDT, J. C. Aggradation and Degradation of Alluvial Sand	
Survey, Through 1986,	Deposits, 1965 to 1986, Colorado River, Grand	SCHROEDER, P. R.
W89-02466 10C	Canyon National Lark, Arizona,	Leachate Collection in Landfills: Steady Case, W89-03102 5E
SCHAEFFER, D. J.		
Innovative Designs for Water Quality Monitor- ing: Are We Asking the Questions Before the		SCHROEDER, W. W. Mobile Bay Estuary: Stratification, Oxygen De-
Data Are Collected,	Influence of Cosolvents on Quinoline Sorption by Subsurface Materials and Clays,	pletion, and Jubilees,
W89-02320 7A		W89-02696 2L

2L

CHUBERT, J. P. Effects of Gas-Pipeline Construction on the	SCRANTON, M. I. Hydrogen (H2) Distributions in the Carmans	SEYFRIED, C. F. Influence of Sludge from Chemical Biological
Aquatic Ecosystem of Canada Creek, Presque	River Estuary,	Wastewater Treatment on Nitrification and Di-
Isle County, Michigan, W89-02861 4C	W89-03194 2L	gestion, W89-02816 5D
	SEAWELL, W. M. Effects of Aeration and Minimum Flow En-	
Effects on Suspended and Substrate Sediments in Two Streams Resulting from Different Gas-Pipeline Installation Techniques,	hancement on the Biota of Norris Tailwater, W89-02826 5G	SHAH, H. J. Pilot-Plant Evaluations of Porous Biomass Supports,
W89-02823 4C	SEBAKHY, I. S.	W89-03104 5D
SCHULMAN, C. L.	Experimental Study of Flow in Settling Tanks,	SHALIGRAM, A. M.
Data on the Distribution and Abundance of Sub-	W89-03107 8B	Evaluation of Sludge Settleability be Floc Char-
mersed Aquatic Vegetation in the Tidal Poto- mac River and Estuary, Maryland, Virginia, and	SECOURS, V. E. Results of a Short-Term Toxicity Study for	acteristics,
the District of Columbia, 1986,	Three Organic Chemicals Found in Niagara	W89-03167 5D
W89-02511 7C	River Drinking Water,	SHAPIRO, J. M. Data on the Distribution and Abundance of Sub-
SCHULTZ, J. R.	W89-03310 5C	mersed Aquatic Vegetation in the Tidal Poto-
Handbook: Improving POTW Performance Using the Composite Correction Program Ap-	SEE, R. B. External Quality-Assurance Results for the Na-	mac River and Estuary, Maryland, Virginia, and
proach,	tional Atmospheric Deposition Program and Na-	the District of Columbia, 1986, W89-02511 7C
W89-02845 5D	tional Trends Network During 1986, W89-02463 7C	
SCHUMM, S. A.		SHARITZ, R. R. Hydrochory and Regeneration in a Bald Cy-
Experimental Geomorphology (Drainage Net-	SEED, H. B. Residual Strength of Sand From Dam Failures	press-Water Tupelo Swamp Forest,
work, Piedmont and Channel Morphology), W89-02847 2J	in the Chilean Earthquake of March 3, 1985,	W89-03295 2H
SCHUURMANS, A. L. G.	W89-02851 8D	SHAUL, G. M.
Effects of Cadmium Exposure on Feeding of	SEED, R. B.	Fate of Water Soluble Azo Dyes in the Activat-
Freshwater Planktonic Crustaceans,	Residual Strength of Sand From Dam Failures in the Chilean Earthquake of March 3, 1985,	ed Sludge Process, W89-02935 5D
W89-03288 5C	W89-02851 8D	
SCHWAB, A. P.	SEGAR, D. A.	SHAW, E. M. Hydrology in Practice,
Groundwater Assessment Modeling Under the Resource Conservation and Recovery Act,	Strategies for Long-Term Pollution Monitoring	W89-02421 2A
W89-02995 5B	of the Coastal Oceans, W89-02319 5A	SHELTON, S. P.
SCHWARTZ, T. R.		Permeable Barriers: A New Alternative for
Gas Chromatographic Residue Patterns of Toxa-	SEITZINGER, S. P. Denitrification in Freshwater and Coastal	Treatment of Contaminated Ground Waters, W89-02355 5G
phene in Fish Samples from the Great Lakes and from Rivers of the Southeastern United States,	Marine Ecosystems: Ecological and Geochemi-	
W89-02328 5B	cal Significance, W89-03256 2H	SHERRARD, J. H. Dye-Sensitized Photochemical Reduction of
SCHWEIGER, F.		PCBs,
Developments in the Design of Bulb Turbines,	SELP, H. M. Critique of Models for Freshwater and Soil	W89-03101 5D
W89-03069 8C	Acidification,	SHIEH, W. K.
SCHWIPPER, W. W.	W89-02967 5B	Anaerobic Fluidized Bed Treatment of an Indus-
Impairment of Mobility and Development in Freshwater Snails (Physa fontinalis and Lym-	SEMB, A. Reversibility of Acidification Shown by Whole-	trial Wastewater, W89-03162 5D
naea stagnalis) Caused By Herbicides,	Catchment Experiments,	
W89-03290 5C	W89-03120 5B	Anoxic/Oxic Activated Sludge Treatment of Cyanogens and Ammonia in the Presence of
SCIACCA, J.	SEMOV, V.	Phenols,
Effects of Acid Mine Drainage on Groundwater Quality at the Leviathan Sulfur Mine, Alpine	Biotechnology for Manganese Removal from Groundwater,	W89-02298 5D
County, California,	W89-03093 5F	SHIOZAWA, T.
W89-02363 5C	SEN GUPTA, R.	Mass Balance of Heavy Metals in the Seto Inland Sea, Japan,
SCIALDONE, J.	DDT Residues in Sediments from the Bay of	W89-03278 5B
Comparison of Northern Hemisphere Snow Cover Data Sets,	Bengal, W89-03198 5B	SHIVARAMAN, N.
W89-02619 7C	SEPPANEN, H.	Biological Treatment of Toxic Industrial Waste,
SCOTT, J. C.	Aquifer Thermal Energy Storage in Finland,	W89-02919 5D
Geohydrology and Susceptibility of Coldwater	W89-03082 4B	SHUCHENG, Z.
Spring and Jacksonville Fault Areas to Surface Contamination in Calhoun County, Alabama,	Biological Treatment of Groundwater in Basins	Analysis of Sediment Transport by Debris Flows in the Jiangjia Gully, Yunnan,
W89-02576 5B	with Floating Filters: II. The Role of Microor-	W89-02909 2J
Geohydrology and Susceptibility of Major	ganisms in Floating Filters, W89-03095 5G	SHUMAN, M. S.
Aquifers to Surface Contamination in Alabama;	Ground Water: A Living Ecosystem,	Comparison of Anodic Stripping Voltammetry
Area 8, W89-02564 5B	W89-03084 2F	Speciation Data with Empirical Model Predic- tions of pCu,
	SEROUDES, J. B.	W89-02646 7B
SCOTT, K. J. Coastal Monitoring: Evaluation of Monitoring	Role of Ice in the Morpho-Sedimentologic	SHUR, L. A.
Methods in Narragansett Bay, Long Island	Regime of a Shoreline in the Middle Saint Law- rence Estuary (Le Role des Glaces dans le	Prediction of Reservoir Phytoplankton Condi-
Sound and New York Bight, and a General	Regime Morpho-Sedimentologique d'un Estran	tion by the Fluorescence Method,
Monitoring Strategy, W89-02325 5A	de l'Estuaire Moyen du Saint-Laurent), W89-03133 2J	W89-03291 2H
SCOTT-SWANK, W. T. S.		SICKMAN, J. O. Chemical and Biological Survey of Lakes and
Dynamics of Water Chemistry in Hardwood and	SETARO, F. Survey of Sensitivity of Southern California	Chemical and Biological Survey of Lakes and Streams Located in the Emerald Lake Water-
Pine Ecosystems,	Lakes to Acid Deposition,	shed, Sequoia National Park,
W89-02900 2K	W89-02864 5C	W89-02852 2H

SIDDIQUE ALI, M. Water-Bearing Zones in the Mining Area of the Northern Region of Bangladesh with Regard to	SINGH, A. K. Effect of Assam Crude on Photosynthesis and Associated Electron Transport System in Ana-	SMITH, L. L. Engineering/Cost Evaluation of Options for Removal/Disposal of NC Fines,
Utilization of Mine Water for Irrigation and Other Uses,	baena doliolum, W89-03207 5C	W89-02933 5D
W89-02369 2F		SMITH, N. P.
CIECI EV C E	SINGH, N. P. Gastrointestinal Absorption of Soluble Uranium	Laguna Madre of Texas: Hydrography of a Hy-
SIEGLEY, C. E. Role of the Seed Bank in the Development of Vegetation on a Freshwater Marsh Created	from Drinking Water, W89-02957 5B	persaline Lagoon, W89-02695 2L
from Dredge Spoil,	CINICII P. P.	
W89-03169 2H	SINGH, R. P. Movement of Carbofuran (Nematicide) in Soil	SMITH, R. Trace Metal Transport in a Tropical Estuary,
SILLIMAN, S. E.	Columns,	W89-03276 ' 2L
Consideration of Dimensional Dependence in	W89-03297 5B	
Modelling the Structure of Flow Zones within the Subsurface,	SINGLETON, L. Flood Inundation Modelling Using MILHY,	SMITH, S. B. Toxicity of Six Heterocyclic Nitrogen Com-
W89-02551 5B	W89-03330 2E	pounds to Daphnia pulex, W89-03315 SC
Development of Estimation Methods for Tribu-	SJOBERG, S.	W89-03315 5C
tary Loading Rates of Toxic Chemicals, W89-02547 5B	Thermodynamic Calculations with Special Ref-	SMITH, S. J.
	erence to the Aqueous Aluminum System, W89-02641 2K	Nitrogen and Ground Water Protection. W89-02679 5G
SILVERSTEIN, M. E. National Surface Water Survey, Western Lake	SKID'KO, F. Y.	W89-02679 5G
Survey (Phase I Synoptic Chemistry) Quality	Prediction of Reservoir Phytoplankton Condi-	SMOOT, C. W.
Assurance Plan,	tion by the Fluorescence Method,	Water Level Measurements 1981-85 and Chemi-
W89-02413 2H	W89-03291 2H	cal Analyses 1978-85, Red River Alluvial Aqui- fer, Red River Valley, Louisiana,
SIMMONDS, S. J.	SKLAR, B. D.	W89-02582 7C
Appendicitis Epidemic Following Introduction	Patapsco Wastewater Treatment Plant Toxicity Reduction Evaluation.	
of Piped Water to Anglesey, W89-03041 5F	W89-02300 5D	SMOOT, J. L.
		Assimilative Capabilities of Retention Ponds, W89-02856 5D
SIMONEIT, B. R. T. Hexachlorophene Distributions in Estuarine	SLAGLE, D. L. Hydrologic and Geologic Data for the Edwards	W 89-02830
Sediments,	Aquifer Recharge Zone Near Georgetown, Wil-	SOARES, M. I. M.
W89-03196 5B	liamson County, Texas, 1986-87, W89-02499 2F	Biological Groundwater Denitrification: Labo-
SIMONS, B. P.		ratory Studies, W89-03096 5F
Blood Gases, Acid-Base Status, Ions, and Hema-	Hydrologic Data for Urban Studies in the	
tology in Adult Brook Trout (Salvelinus fontina- lis) Under Acid/Aluminum Exposure,	Austin Metropolitan Area, Texas, 1986, W89-02597 4C	In Situ Biological Groundwater Denitrification
W89-03236 5C		Concepts and Preliminary Field Tests, W89-03097 5G
Effects of Aluminum and Law all on Not Ion	SLAYMAKER, H. O. Variable Solute Sources and Hydrological Path-	W 05-05057
Effects of Aluminum and Low pH on Net Ion Fluxes and Ion Balance in the Brook Trout	ways in a Coastal Subalpine Environment,	SOBCHAK, L.
(Salvelinus fontinalis),	W89-02901 2K	Dry Wells - Solution or Pollution: An Arizona Status Report,
W89-03235 5C	SLUPIK, J.	W89-02338 5E
Physiological Evidence of Acclimation to Acid/	Water and Sediment Dynamics of the Homerka Catchment.	
Aluminum Stress in Adult Brook Trout (Salve- linus fontinalis): I. Blood Composition and Net	W89-02895 2J	SOEKARDI, R.
Sodium Fluxes,	SLY, P. G.	Status of Hydrogeological Mapping in Indonesia in 1983,
W89-03237 5C	Interstitial Water Quality of Lake Trout Spawn-	
Physiological Evidence of Acclimation to Acid/	ing Habitat,	
Aluminum Stress in Adult Brook Trout (Salve-	W89-03172 5C	SONNTAG, C. Role of Tracer Data for Modeling Soil-Water
linus fontinalis): II. Blood Parameters by Cannu-	SMART, P. L.	Flow in the Unsaturated Zone.
lation, W89-03238 5C	Controls on the Composition of Authigenic Per- colation Water in the Burren, Ireland,	W89-03013 2G
	W89-02730 2K	SORENSEN, D. L.
SIMONS, D. B. Differences Between Gravel- and Sand-bed	SMED-HILDMANN, R.	In Situ Biological Treatment of Hazardou
Rivers,	Microbial Activity in Sanitary Landfills: A Pos	. Waste-Contaminated Soils,
W89-02431 2J	sible Source of the Humic Substances in	
SIMONS, R. K.	Groundwater, W89-03079 5E	SPAULDING, W. G.
Differences Between Gravel- and Sand-bed		Vegetation and Climates of the Last 45,00
Rivers, W89-02431 2J	SMETTEM, K. R. J. Hydrology and Solute Uptake in Hillslope Soil	Years in the Vicinity of the Nevada Test Site
	on Magnesian Limestone: the Whitwell Wood	South-Central Nevada, W89-03024
SIMPSON, A. T. Hydrogeological Mapping in Fiji,	Project,	
W89-02366 2F	W89-02891 2C	SPENCER, I.
SIMS, J. L.	SMITH, B. J. Water Resources Activities of the U.S. Geologi	Phytokarst, Blue-green Algae and Limeston Weathering.
In Situ Biological Treatment of Hazardous	cal Survey in Missouri, Fiscal Year 1987,	W89-02732 21
Waste-Contaminated Soils,	W89-02470 90	
W89-02923 5D	SMITH, D. L.	STAHR, J. J. Engineering/Cost Evaluation of Options for Re
SIMS, R. C.	Hydrologic and Riparian Influences on th	moval/Disposal of NC Fines,
Biological Transformation and Detoxification of 7,12-Dimethylbenz(a)anthracene in Soil Systems,	import and otorage of course runteenine of	W89-02933 51
W89-03161 5B	ganic Matter in a Prairie Stream, W89-03214 21	STALLARD, M. L.
In Situ Biological Treatment of Hazardous		Dye-Sensitized Photochemical Reduction
Waste-Contaminated Soils,	Modeling Acid Migration Through Soils,	PCBs,
W89-02923 5D		B W89-03101 51

5D

STALLING, D. L. Gas Chromatographic Residue Patterns of Toxa- phene in Fish Samples from the Great Lakes and from Rivers of the Southeastern United States, W89-02328 5B	Potential for Treatment of Hazardous Organic Chemicals with Biological Processes, W89-02929 5D	Rocky Mountain Acid Deposition Model As- sessment: Evaluation of Mesoscale Acid Deposi- tion Models for Use in Complex Terrain,
W 89-02328 3B	STORHAUG, R.	W89-02969 5B
STAMER, J. K. Assessment of Water Quality and Factors Affecting Dissolved Oxygen in the Sangamon River. Decatur to Riverton, Illinois, Summer	Pretreatment of Sludge Liquors in Sewage Treatment Plants, W89-02817 5D	SUBRAHMANYAM, P. V. R. Biodegradation for Recalcitrant Industrial Wastes,
1982, W89-02486 5B	STOTTLEMYER, R. Monitoring and Quality Assurance Procedures	W89-02926 5D
STAMM, J. M. Pilot Scale Evaluation of Sludge Landfilling:	for the Study of Remote Watershed Ecosystems, W89-02330 5A	SUBRAMANIAM, S. Engineering, Mosquitoes and Filariasis: A Case Report,
Four Years of Operation, W89-02978 5E	STOTTMEIER, K. D. Concentration of Mycobacterium avium by Hos-	W89-03065 5G
STAMMAN, E.	pital Hot Water Systems, W89-03304 5B	SUFFET, I. H.
Strategies for Long-Term Pollution Monitoring of the Coastal Oceans,	STOTTMEISTER, U.	Pretreatment of Drinking Water to Control Or- ganic Contaminants and Taste and Odor, W89-02793 5F
W89-02319 5A	Aerobic Treatment of Sewage from Lignite (Brown Coal) Processing,	
STAMPER, J. H. Diflubenzuron Application to Citrus and Its	W89-02915 5D	SUHARYONO, I. Vibration and Leakage of Weir Gates,
Impact on Invertebrates in an Adjacent Pond, W89-03208 5C	STOWE, L. L.	W89-03073 8C
	Nimbus-7 Global Cloud Climatology: Part I. Algorithms and Validation,	SULLIVAN, E. C.
STANFORD, J. A. Hyporheic Habitat of River Ecosystems,	W89-03307 2B	Patapsco Wastewater Treatment Plant Toxicity Reduction Evaluation,
W89-03122 2E	STRAUB, J.	W89-02300 5D
STANG, P. M. Portable Environment Test System: A Field As-	New System of Seepage Sampling for the Deter- mination of Volatile Organic Substances (Neues	SUNADA, D.
sessment of Organotin Leachates. Test and Eval-	System der Sickerwassergewinnung zur Bestim- mung Leichtfluchtiger Organischer Spuren-	Recharge as Augmentation in the South Platte Basin,
uation, W89-03324 5C	stoffe),	W89-02482 4B
STECHER, L. S.	W89-03047 5A	
Quantity and Quality of Recharge to the Ogal- lala Aquifer from Urban Runoff,	STRENGE, D. L. Groundwater Assessment Modeling Under the	SUNDARESAN, B. B. Biodegradation of Recalcitrant Industrial
W89-02340 4C	Resource Conservation and Recovery Act,	Wastes, W89-02926 5D
STEEDMAN, R. J.	W89-02995 5B	
Modification and Assessment of an Index of Biotic Integrity to Quantify Stream Quality in	STROH, E. M. D. Temporal Relationship of Vibrio parahaemolyti-	SUNG, J. F. C. Sewage Hardness and Mortality from Cancer
Southern Ontario, W89-03211 4C	cus in Patients and the Environment, W89-03064 5B	and Cardiovascular Disease, W89-03309 5D
STEPHENS, D. B. Field Simulation of Waste Impoundment Seep-	STRONG, L. A. Dynamics of Lake Michigan Phytoplankton: Re-	SURDEANU, V. Landsliding, Slope Development and Sediment
age in the Vadose Zone, W89-02348 5B	lationship to Nitrogen and Silica Fluxes, W89-03230 2H	Yield in a Temperate Environment: Northeast Romania,
Field Study of Ephemeral Stream-Aquifer Inter-		W89-02897 2J
action, W89-02349 2F	STROO, H. F. Effects of Ozone and Acid Rain on White Pine	SUSTRISNO, S.
STEVENSON, J. C.	(Pinus strobus) Seedlings Grown in Five Soils: II. Mycorrhizal Infection,	Status of Hydrogeological Mapping in Indonesia
Comparative Ecology of Submersed Grass Beds	W89-03057 5C	in 1983, W89-02375 7B
in Freshwater, Estuarine, and Marine Environ-	Effects of Ozone and Acid Rain on White Pine	
ments, W89-03264 2H	(Pinus strobus) Seedlings Grown in Five Soils: III. Nutrient Relations,	SUTHERLAND, A. J. Static Armour Layers by Selective Erosion,
STEWART, B. A.	W89-03058 5C	W89-02439 2J
U.S.D.A. Agricultural Research Service Commitment to Ground Water Research,	STRUCKMEIER, W.	SUTHERSAN, S.
W89-02655 3F	International Legend for Hydrogeological Maps: Principles and Application,	Utilization of Nitrite Oxidation Inhibition to Im- prove the Nitrogen Elimination Process,
STIGEBRANDT, A.	W89-02386 7B	W89-02288 5D
Dynamic Control by Topography in Estuaries, W89-02684 2L		CUIWA II
	STUART, J. D. Groundwater Protection by Accelerated Testing	SUWA, H. Some Relationships Between Debris Flow
STOCKNER, J. G. Phototrophic Picoplankton: An Overview from	of Organic Chemical Breakthroughs of Soil Bar- riers,	Motion and Micro-Topography for the Kamika- mihori Fan, North Japan Alps,
Marine and Freshwater Ecosystems, W89-03259 2H	W80.02585 5A	W89-02907 2J
STONE, A. T.	STULL, E. A.	SUZANNE, P.
Introduction to Interactions of Organic Com-	Cumulative Impact Assessment: Issues to Con-	Vulnerability Study of the Aubergenville Aqui-
pounds with Mineral Surfaces, W89-02643 5B	sider in Selecting a Cumulative Assessment Method,	fer, W89-03077 5B
STONE, A. W.	W89-02965 5C	SUZUKI, S.
River Conservation - Implications for Legisla- tion,	STUMM, W. Predicting the Effects of a Pesticide Release to	Xanthene Dye Chemiluminescence for Determi- nation of Free Chlorine in Water,
W89-02992 6E	the Rhine River, W89-03159 5C	W89-03183 7B
STONE, W. J. Recovery of Moisture/Solute Profiles in Re-		SVEUM, P.
claimed Coal-Mine Spoil, Northwest New		Oil Spill Combat in the Arctic - An Alternative
Mexico,	the Technique of Terrain Classification,	Approach,
W89-02360 2F	W89-02372 7B	W89-02966 5G

SWACKHAMER, D. L. Horizontal and Vertical Distribution of PCBs in Southern Lake Michigan Sediments and the Effect of Waukegan Harbor as a Point Source,	TAUSS, J. W. Effects of Snow Cover and Tropical Forcing on Mid-Latitude Monthly Mean Circulation, W89-02625 2C	THERRIAULT, J. Interrelationship Between In Vivo Fluorescence of Phytoplankton and Light Beam Transmission with Reference to Fluorescence Yield.
W89-03170 5B	TAVANGAR, J.	W89-03233 2L
SWALES, S.	Optimizing Operation and Maintenance of	THIROS, S. A.
Fish Populations of a Small Lowland Channel- ized River in England Subject to Long-Term	Water Supply Wells, W89-02333 6B	Elected Hydrologic Data for Pahvant Valley and Adjacent Areas, Millard County, Utah,
River Maintenance and Management Works, W89-03139 6G	TAYLOR, J. Extending the Operating Life of Hydro Equip-	1987, W89-02569 7C
SWANGO, L. J. New Disinfection Agents for Water,	ment, W89-03156 8C	THIRUMURTHI, D.
W89-02970 5F	TAYLOR, W. D.	Phosphate Requirement for Anaerobic Fixed Film Treatment of Landfill Leachate,
SWANK, W. T. Dynamics of Water Chemistry in Hardwood and	Contrasting Diel Patterns of Vertical Migration in the Dinoflagellate Ceratium hirundinella in	W89-03132 5D
Pine Ecosystems,	Relation to Phosphorus Supply in a North Tem-	THOMAS, R. B. Monitoring Baseline Suspended Sediment in
W89-02900 2K SWANSON, G. A.	perate Reservoir, W89-03221 2H	Forested Basins: The Effects of Sampling on Suspended Sediment Rating Curves,
Hydrology and Chemistry of Selected Prairie Wetlands in the Cottonwood Lake Area, Stuts-	TEE, K. T. Modeling of Tidally Induced Residual Currents,	W89-03053 2J
man County, North Dakota, 1979-82, W89-03035 2H	W89-02690 2L	THOMAS, R. K. Ground Water Recharge for Oklahoma: An
SWEENEY, J. K.	TENU, A. Isotopic Investigation on the Evolution of	Analysis of Past and Future Methodology, W89-02660 4B
Acid Precipitation in North America: 1985	Groundwater Dynamics in the Principal	THOMASON, D. E.
Annual and Seasonal Data Summaries from Acid Deposition System Data Base,	Aquifers in the Southern Dobrudja, W89-02853 2F	Economic And Environmental Impacts of Using Municipal Sewage Effluent for Agricultural
W89-02997 5B	TERNAN, J. L.	Production,
SWEETING, M. M. Stable Isotopes: An Investigation into Their Ap-	Hydrochemical Characteristics of a Dartmoor Hillslope.	W89-02663 5E
plication in Karst Hydrology in the U.K., with Special Reference to the Malham Area, North	W89-02903 2E	THOMPSON, G. Reservoir Sedimentation and Influence of Flush-
Yorkshire,	Karst Water Temperature and the Shaping of Malham Cove, Yorkshire,	ing, W89-02457 2J
	W89-02737 2F	
SWITZENBAUM, M. S. Microtox Assessment of Anaerobic Bacterial	TERSKOV, I. A.	THOMPSON, K. Assessment of the Adequacy of the Ground-
Toxicity, W89-02301 5D	Prediction of Reservoir Phytoplankton Condi- tion by the Fluorescence Method,	Water Monitoring System for Artificial Re- charge of Aquifers in the Los Angeles Area,
SYLVESTRI, P.	W89-03291 2H	California, W89-02335 7A
Waste Minimization Audit Report: Case Studies of Minimization of Solvent Wastes and Electro-	TESSIER, A. Effect of pH on Iron and Manganese Uptake by	THOMPSON, R. E.
plating Wastes at a DOD (Department of De- fense) Installation,	a Green Alga, W89-03246 5C	Natural Flow and Water Consumption in the Milk River Basin, Montana and Alberta, Canada,
W89-02839 5D	Partitioning of Trace Metals in Sediments,	W89-03004 2E
SYROTYNSKI, S.	W89-02649 5B	THOMPSON, S. M.
Asbestos-Contaminated Drinking Water: Its Impact on Household Air,	TESTA, S. M.	Field Measurements in a Gravel-bed River which Confirm the Theory of White et al.,
W89-03299 5B	Advantages of Suction Lift Hydrocarbon Re- covery Systems: Application At Three Hydro-	W89-02446 2J
SZOLGAY, J. Hydrology versus Water Resources Manage-	geologic Environments in California, W89-02358 5G	THOMSON, B. M. Modeling Acid Migration Through Soils,
ment, W89-02724 2A	Impact of the Newport-Inglewood Structural	W89-02361 5B
Mathematical Modelling,	Zone on Hydrogeologic Mitigation Efforts: Los Angeles Basin, California,	Permeable Barriers: A New Alternative for
W89-02725 2A	W89-02342 2F	Treatment of Contaminated Ground Waters, W89-02355 5G
SZOLLOSI-NAGY, A.	TETLA, R. A.	THORNE, C. R.
Surface Water Hydrology, W89-02719 2E	Wastewater Characterization and Hazardous Waste Survey, Castle AFB, CA,	Analysis of Bank Stability in the DEC Water- sheds, Mississippi,
TACCONI, P.	W89-02704 5D	W89-02825 4D
Bed Load Transport Measurements by the Vortex-tube Trap on Virginio Creek, Italy,	TEIT, P. B. Plankton,	Flow Processes and River Channel Morpholo-
W89-02449 7B	W89-02770 2L	gy, W89-02910 2J
TAKAHASHI, M.	THAPA, G. S.	Sediment Supply, Movement and Storage in an
Change in Distribution Patterns of Photosynthe- tically Incorporated C during Phytoplankton Bloom in Controlled Experimental Ecosystem,	Hydrogeology of the Butwal-Bhairahwa Area, Lumbini Zone, Nepal, W89-02380 2F	Unstable Gravel-Bed River,
W89-03059 2L	THEIS, T. L.	THORNES, J. B.
TAN, C. K. Degradation of Bromoform and Chlorodibromo-	Reactions and Transport of Trace Metals in	Floodplain Response of a Small Tropical Stream,
methane in a Catalyzed H2-Water System,	W89-02644 5B	
W89-03311 2K	THELIER, Y.	THORNTON, J. L.
TANIGUCHI-DENNIS, D.	Anaerobic Digestion of Chemical Industry	
Unit Process Tradeoffs for Combined Trickling Filter and Activated Sludge Processes,	Downflow Fixed Film Technology.	ern California,
W89-03160 5D	W89-02291 5D	W89-03028 2J

AUTHOR INDEX

THORSTENSON, D. C.

THORSTENSON, D. C.	TRAN, F. T.	TURCO, R. F.
Concept of Electron Activity and its Relation to Redox Potentials in Aqueous Geochemical Sys-	Syntrophic Bacteria Process to Convert a Pulp Mill's Spent Sulphite Liquor to Hydrogen Sul- phide,	Agricultural Impact on Groundwater Quality W89-02549 5E
tems, W89-02580 2K	W89-03115 5D	TURK, J. T.
Hydrogeochemistry of the Upper Part of the Fort Union Group in the Gascoyne Lignite Strip-Mining Area, North Dakota, W89-03026 4C	TRIMBEE, A. M. Comparison of In Situ Estimates of Chlorophyll a Obtained with Whatman GF/F and GF/C Glass-Fiber Filters in Mesotrophic to Hypereu-	Methods for Hydrologic Monitoring of Surface Mining in the Central-Western United States W89-02490 7A
	tophic Lakes,	TURNPENNY, B.
THUNELL, R. C. Giacio-Eustatic Sea-Level Control on Red Sea Salinity,	W89-03217 7B TRIPATHI, V. S.	Stormflow Characteristics of Three Small Lime stone Drainage Basins in North Island, New Zealand,
W89-03119 2L	Lagrangian-Eulerian Approach to Modeling Hydrogeochemical Transport of Multi-Compo-	W89-02735 2A
TIETGE, J. E. Morphometric Changes in Gill Secondary La-	nent Systems, W89-03320 5B	TWIDWELL, L. G. Pilot Scale Results of Metal Value Recovery
mellae of Brook Trout (Salvelinus fontinalis) after Long-Term Exposure to Acid and Alumi-	TRIPP, B. W.	from Mixed Metal Hydroxide Sludges, W89-02394 5D
num,	'Mussel Watch'Measurements of Chemical Pol- lutants in Bivalves as One Indicator of Coastal	
W89-03243 5C	Environmental Quality,	TYAGI, R. D.
TIGHT, D. C.	W89-02326 5A	Syntrophic Bacteria Process to Convert a Pul- Mill's Spent Sulphite Liquor to Hydrogen Sul
Applying Electrical Resistance Blocks for Un- saturated Zone Monitoring at Arid Sites, W89-02352 7B	TROISI, S. Application of a Transport-Diffusion Model to a	phide, W89-03115 5E
	Coastal Aquifer Utilizing In situ Measurements of Dispersivity,	TVI ED C
TOCHER, R. J. Design and Construction of a Subsurface Gaso-	W89-03016 2F	TYLER, G. Soil Acidification and Metal Solubility in For
line Recovery System Westminster, Colorado,	TROUDE, J. P.	ests of Southern Sweden,
W89-02357 5G	Role of Ice in the Morpho-Sedimentologic Regime of a Shoreline in the Middle Saint Law-	W89-02308 51
тонуа, у.	rence Estuary (Le Role des Glaces dans le	TYSSELING, J. C.
Anaerobic Biological Process for the Prevention of Noxious Odors in Pulp Manufacturing, W89-02928 5D	Regime Morpho-Sedimentologique d'un Estran de l'Estuaire Moyen du Saint-Laurent),	Projections of Water Availability in the Lowe Rio Grande, Gila-San Francisco and Mimbre
	W89-03133 2J	Drainage Basins to 2005, W89-02474 6I
TOLG, G. Determination of Traces of Thallium in Various	TRUDGILL, S. T.	
Matrices,	Controls on the Composition of Authigenic Per- colation Water in the Burren, Ireland,	UCHRIN, C. G.
W89-03067 5A	W89-02730 2K	Characteristics of the Sorption of Chlorothaloni and Azinphos-Methyl to a Soil from a Commer
TOMAN, M.	Hydrology and Solute Uptake in Hillslope Soils	cial Cranberry Bog,
Comparison Between Waste Water Treatment in Completely Mixed and Fluidized Bed Reactors:	on Magnesian Limestone: the Whitwell Wood Project,	W89-03195 51 UDLUFT, P.
Development and Structure of Biomass (Verg- leich der Absasserreinigung im Ruhr - und im	W89-02891 2G	New System of Seepage Sampling for the Deter
Wirbelbettreaktor Sowie Entwicklung und Struktur der Biomasse),	Limestone Weathering Under a Soil Cover and the Evolution of Limestone Pavements, Malham	mination of Volatile Organic Substances (Neue System der Sickerwassergewinnung zur Bestim
W89-03045 5D	District, North Yorkshire, UK, W89-02740 2J	mung Leichtfluchtiger Organischer Spurer stoffe),
TOMES, P.	TRUESDALE, R. S.	W89-03047 54
Geomembrane Liner Reduces Leakage in Un- derground Reservoir,	U.S. Production of Manufactured Gases: Assess-	UNCLES, R. J.
W89-03281 5F	ment of Past Disposal Practices, W89-02964 5E	Tidal Dynamics of Estuaries, W89-02687 21
TOMS, G. Ocean Outfall System for Dense and Buoyant	TSAI, SC.	
Effluents,	Chlorine Sensitivity of Early Life Stages of Freshwater Fish,	UNNY, T. E. Probability and Stochastic Modelling of Water
W89-03108 5E	W89-03333 5C	Quality Parameters in the Thames River, W89-03135
TORNES, L. H. Water Quality Data for Orwell Reservoir and	TSAKIRIS, G. Stochastic Modelling of Rainfall Occurrences in	
the Otter Tail River Near Fergus Falls, Minne-	Continuous Time,	UNSWORTH, M. H. Consequences of Cloud Water Deposition o
sota, W89-02605 5B	W89-03049 2B	Vegetation at High Elevation,
	TSANG, A. Y.	W89-02305 5
TOTMAN, D. L. Statewide Groundwater Quality Monitoring	Concentration of Mycobacterium avium by Hos- pital Hot Water Systems,	UPTON, S. L.
Network Design,	W89-03304 5B	Development and Field Use of a Snow Collect
W89-02343 5A	TSO, W. K.	tor for Acid Precipitation Studies,
TOWLER, P. A.	Behaviour of Buried Small Flexible Pipes,	W89-02945 5
Effect of Unsaturated/Saturated Zone Property	W89-03137 8G	URBAN, N. R.
Upon the Hydrogeochemical and Microbiologi- cal Processes Involved in the Migration and	TSUKAMOTO, T.	Proton Cycling in Bogs: Geographical Variation in Northeastern North America.
Attenuation of Landfill Leachate Components,	Calculation of Prototype Cavitation Characteris- tics in Large Bulb Turbines,	W89-02316 5
W89-03087 5B	W89-03070 8C	
TOYOSHIMA, A.	TUMUR, L.	VADNAL, J. L. North Alabama Water Quality Assessmen
Reuse of Chemical Sludge for Conditioning of	Water Resources and Hydrogeological Mapping	North Alabama Water Quality Assessment Volume VIII - Water Quality Modeling,
Biological Sludges, W89-02815 5D	in the Mongolian People's Republic, W89-02379 2F	W89-02702 5
TRABALKA, J. R.		VADSTEIN, O.
Chlorine Sensitivity of Early Life Stages of	TUNG, YK. Probability Distribution for Critical DO Loca-	Growth and Phosphorous Status of Limnet
Freshwater Fish, W89-03333 5C	tion in Streams,	Phytoplankton and Bacteria, W89-03244
W89-03333 5C	W89-03292 7B	W 09-U3244 2

VAIDYA, Y. L.	VANSOESTBERGEN, J. G.	VINK, M.
Hydrogeology of the Butwal-Bhairahwa Area, Lumbini Zone, Nepal,	Use of Remote Gauging to Measure Sewer Invert Elevations and Head Loss,	Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ioniza-
W89-02380 2F	W89-03280 5D	tion Detection,
VALE, E. B.	VANZON, H. J. M.	W89-03287 5A
Pilot-Scale Anaerobic Biomass Acclimation	Sources of Variation of Soil Erodibility in	VIS, M.
Studies with a Coal Liquefaction Wastewater, W89-02297 5D	Wooded Drainage Basins in Luxembourg, W89-02893 2J	Surface and Subsurface Sources of Suspended Solids in Forested Drainage Basins in the
VALI, G.	*******	Keuper Region of Luxembourg,
Estimate of Precipitation Enhancement Potential	VAUX, H. J. Growth and Water in the South Coast Basin of	W89-02892 2J
for the Duero Basin of Spain, W89-03306 3B	California, W89-02636 6D	VIVYURKA, A. J.
	W89-02030 0D	Migration of Acidic Groundwater Seepage from
VALLI, V. E. Results of a Short-Term Toxicity Study for	VEENHUIS, J. E.	Uranium-Tailings Impoundments: 1. Field Study and Conceptual Hydrogeochemical Model,
Three Organic Chemicals Found in Niagara	Effects of Runoff Controls on the Quantity and Quality of Urban Runoff at Two Locations in	W89-03037 5B
River Drinking Water, W89-03310 5C	Austin, Texas,	Migration of Acidic Groundwater Seepage from
	W89-02518 5B	Uranium-Tailings Impoundments: 2. Geochemi-
VAN BREEMEN, N. Differences in Aluminum Mobilization in Spodo-	VEJINS, V. R.	cal Behavior of Radionuclides in Groundwater,
sols in New Hampshire (USA) and in the Neth-	Economic Evaluation of Carbon Adsorption/	W89-03038 5B
erlands as a Result of Acid Deposition,	Ion Exchange Wastewater Treatment Options for Sunflower AAP NQ Wastewater Treatment	VOGEL, D. A.
W89-02309 5B	Facility,	Biology of the Yellow Perch in Lake Sharpe,
VAN DE KREEKE, J.	W89-02828 5D	South Dakota, 1964-1975,
Dispersion in Shallow Estuaries,	MENOCA A D	W89-02428 2H
W89-02685 2L	VENOSA, A. D. Municipal Wastewater Treatment Technology	Limnological and Fishery Studies on Lake
VAN DER POLL, J. M.	Transfer Activities of the United States Environ-	Sharpe, a Main-stem Missouri River Reservoir,
Capillary Gas Chromatographic Determination	mental Protection Agency,	1964-1975,
of Amitrole in Water with Alkali Flame Ioniza-	W89-03325 5D	W89-02423 2H
tion Detection, W89-03287 5A	VENTRESQUE, C.	VOLSKAY, V. T.
	New Coagulant Injection Process,	Toxicity of Selected RCRA Compounds to Ac-
VAN GEMERT, W. J. T. Literature Study on the Feasibility of Microbio-	W89-02798 5F	tivated Sludge Microorganisms,
logical Decontamination of Polluted Soils,	VICTORIA, R.	W89-03165 5D
W89-02916 5G	Biogenic Gases and the Oxidation and Reduc-	VON HAGEL, G.
VAN LOON, J. C.	tion of Carbon in Amazon River and Floodplain	Synergistic Approach to Physical-Chemical
Determination of Tin in Environmental Samples	Waters, W89-03247 2E	Wastewater Pretreatment in the Food Industry,
by Graphite Furnace Atomic Absorption and		W89-02802 5D
Inductively Coupled Plasma-Mass Spectrome-	VILES, H. A.	VONTOBEL, J.
try, W89-03303 5A	Phytokarst, Blue-green Algae and Limestone Weathering,	Uprating the Laufenburg Swiss/German Power
	W89-02732 2K	Station with Ten Straflo Units,
VAN LUIN, A. B. Clean Technology in the Netherlands: The Role	VILLENEUVE, D. C.	W89-03071 8C
of the Government,	Results of a Short-Term Toxicity Study for	VOOGT, P. A.
W89-02801 5G	Three Organic Chemicals Found in Niagara	Effects of Cadmium on Consumption, Assimila-
VAN STARKENBURG, W.	River Drinking Water,	tion and Biochemical Parameters of Daphnia magna: Possible Implications for Reproduction,
Clean Technology in the Netherlands: The Role	W89-03310 5C	W89-03289 5C
of the Government,	VILLENEUVE, JP.	
W89-02801 5G	Sensitivity Analysis of Adsorption and Degrada-	VOYTIK, A.
VAN VEEN, H. J.	tion Parameters in the Modeling of Pesticide Transport in Soils,	Statistical Analyses of Flood Frequency, Low- Flow Frequency and Flow Duration of Streams
Literature Study on the Feasibility of Microbio- logical Decontamination of Polluted Soils,	W89-03150 2G	in the Philadelphia Area, Pennsylvania,
W89-02916 5G	VILSMEIER, K.	W89-02492 2E
	Investigations on Leaching of Dicyandiamide	VURRO, M.
VANAMAIL, P. Engineering, Mosquitoes and Filariasis: A Case	and its Decomposition in Flooded Soils (Unter-	Application of a Transport-Diffusion Model to a
Report,	suchungen zur Auswaschung von Dicyandiamid	Coastal Aquifer Utilizing In situ Measurements
W89-03065 5G	und Dessen Abbau in Uberstauten Boden), W89-03043 5B	of Dispersivity, W89-03016 2F
VANBELLE, G.	777 7777	W89-03016 2F
Sewage Hardness and Mortality from Cancer	VINCENT, P.	WADDELL, K. M.
and Cardiovascular Disease,	Alkalinity Measurements in Karst Water Stud- ies,	Water Quality of Canyon Lake, Central Texas,
W89-03309 5D	W89-02729 2F	W89-02579 2H
VANDERPLOEG, H. A.	Kamenitzas of Gait Barrows National Nature	WAIT, R. L.
Operations for an Under-Ice Ecology Program, W89-03179 2H	Reserve, North Lancashire, England,	Configuration and Hydrology of the Pre-Creta-
	W89-02741 2F	ceous Rocks Underlying the Southeastern Coast-
VANDERSLUIS, I.	VINIKOUR, W. S.	al Plain Aquifer System, W89-03007 2F
Effects of Cadmium on Consumption, Assimila- tion and Biochemical Parameters of Daphnia	Effects of Gas-Pipeline Construction on the	
magna: Possible Implications for Reproduction,	Aquatic Ecosystem of Canada Creek, Presque	WALKER, D. T.
W89-03289 5C	Isle County, Michigan,	Why Not Simplify Wastewater Compliance, W89-02397 5D
VANDEVELDE, T.	W89-02861 • 4C	
Interrelationship Between In Vivo Fluorescence	Effects on Suspended and Substrate Sediments	WALKER, R. L.
of Phytoplankton and Light Beam Transmission	in Two Streams Resulting from Different Gas-	Effects of Low pH and Aluminum on Ventila- tion in the Brook Trout (Salvelinus fontinalis),
with Reference to Fluorescence Yield, W89-03233 2L	Pipeline Installation Techniques, W89-02823 4C	W89-03240 5C

AUTHOR INDEX

WALLACE, M. G.

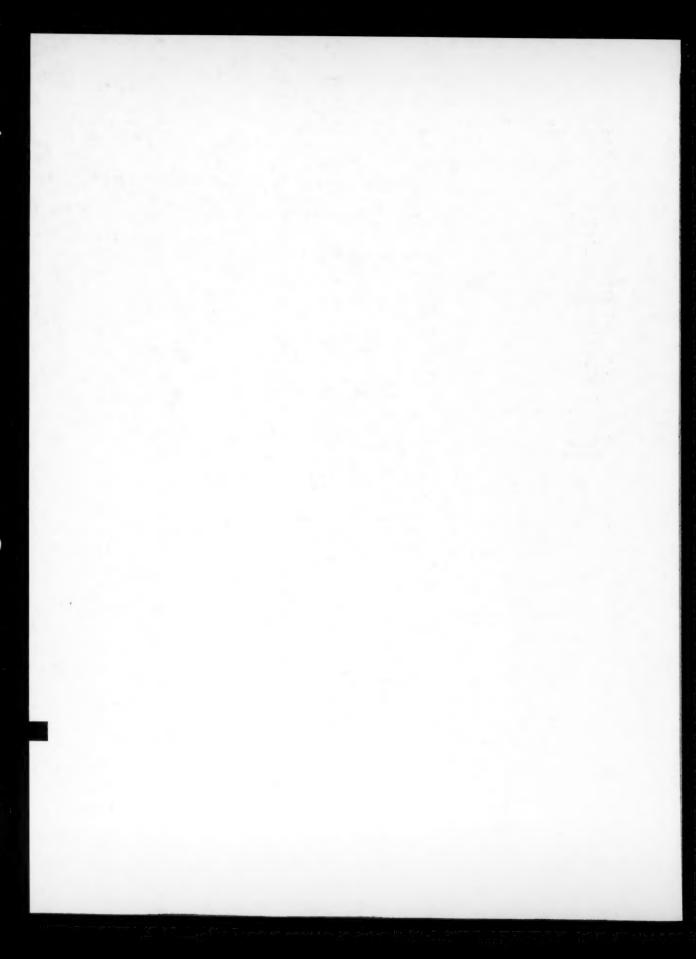
WALLACE, M. G. Toward Sustaining a Desert Metropolis: Water	Recent Advances in Magnetic Processes, W89-02961 5D	Contrasting Patterns of Net- and Nanoplankton
and Land Use in Tucson, Arizona,		Production and Biomass Among Lakes,
W89-02637 6D	Simplified Laboratory Procedures for DO De-	W89-03218 2H
WALLING, D. E.	termination (APHA/AWWA/ WPCF Method), W89-02958 7B	WATTS, R. G.
Catchment Experiments in Fluvial Geomorpho-		Evaluation of the Acute Toxicity to Juvenile
logy: A Review of Objectives and Methodolo-	Treatment of Farnham and Ashley Reservoir Water by Krofta Sandfloat Process System	Pacific Salmonids of Hexazinone and its Formu-
gy, W89-02881 2E	Final Project Report,	lated Products: Pronone 10G, Velpar L, and
	W89-02951 5F	Their Carriers, W89-03316 5C
Magnitude and Frequency Characteristics of	Treatment of Farnham and Ashley Reservoir	W89-03316 5C
Suspended Sediment Transport in Devon Rivers,	Water by Krofta Sandfloat Process System	WAY, W.
W89-02904 2J	Project Documentation,	Geomembrane Liner Reduces Leakage in Un-
Suspended Load in Gravel-Bed Rivers: UK Ex-	W89-02950 5F	derground Reservoir, W89-03281 5F
perience,	Treatment of Potable Water from Seoul, Korea	W 87-03281 3F
W89-02452 2J	by Flotation, Filtration and Adsorption,	WEAVER, M.
Suspended Sediment Properties and Their Geo-	W89-03319 5F	Diflubenzuron Application to Citrus and Its
morphological Significance,	Treatment of Rome Raw Water by Krofta Sand-	Impact on Invertebrates in an Adjacent Pond, W89-03208 5C
W89-02899 2J	float Process System - Project Documentation	W 05-03200
WALLUS, R.	(Part A), W89-02941 5F	WEBB, B.
Effects of Aeration and Minimum Flow En-		Hydrological Sciences in Perspective,
hancement on the Biota of Norris Tailwater,	Treatment of Rome Raw Water by Krofta Sand-	W89-02718 2A
W89-02826 5G	float Process System Project Documentation (Part B),	WEBB, B. W.
WALMSLEY, R. D.	W89-02942 5F	Emerging Issues in Surface Water Quality Re-
Uses of, and Human Impact on Rivers,	Treatment of Rome Raw Water by Krofta Sand-	search, W89-02721 5G
W89-02988 4C	float Process System - Project Documentation	W89-02/21 3G
WALSH, J. E.	(Part C),	Erosion and Sedimentation,
Snow Cover, Cyclogenesis and Cyclone Trajec-	W89-02943 5F	W89-02723 2J
tories, W89-02607 2C	WANG, M. H.	Magnitude and Frequency Characteristics of
	Simplified Laboratory Procedures for DO De-	Suspended Sediment Transport in Devon
WALSH, J. J.	termination (APHA/AWWA/ WPCF Method),	Rivers,
Pilot Scale Evaluation of Sludge Landfilling: Four Years of Operation,	W89-02958 7B	W89-02904 2J
W89-02978 5E	WANG, M. H. S.	Suspended Load in Gravel-Bed Rivers: UK Ex-
WALTERS, W. H.	BOD and Nutrient Removal by Biological A/O	perience,
Rationale for the Design of Monitoring Well	Process Systems, W89-03326 5D	W89-02452 2J
Screens and Filter Packs,		WEBBER, J. S.
W89-03332 5B	WANG, S.	Asbestos-Contaminated Drinking Water: Its
WALTHAM, A. C.	Relationships between Snow Cover and Tem- perature in the Lower Troposphere, General	Impact on Household Air,
Valley Excavation in the Yorkshire Dales Karst,	Circulation in East Asia and Precipitation in	W89-03299 5B
W89-02742 2F	China,	WEBER, A. S.
WALTON, J. C.	W89-02609 2C	Offline Bioregeneration of Granular Activated
Evaluation of Municipal Solid Waste Landfill	WANG, T. C.	Carbon,
Cover Designs, W89-02871 5E	Degradation of Bromoform and Chlorodibromo-	W89-03103 5D
	methane in a Catalyzed H2-Water System, W89-03311 2K	WEEKS, J. B.
WALTRIP, G. D.		Effects of Future Ground-Water Pumpage on
Enhanced Secondary Treatment Incorporating Biological Nutrient Removal,	WANG, Z. Modeling the Effects of Adsorbed Hydrolyzed	the High Plains Aquifer in Parts of Colorado,
W89-03163 5D	Al(III)-Ions on Deep Bed Filtration,	Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming,
WAN, M. T.	W89-02796 5F	W89-03031 2F
Evaluation of the Acute Toxicity to Juvenile	WARD, J. V.	
Pacific Salmonids of Hexazinone and its Formu-	Hyporheic Habitat of River Ecosystems,	Summary of the High Plains Regional Aquifer- System Analysis in Parts of Colorado, Kansas.
lated Products: Pronone 10G, Velpar L, and	W89-03122 2E	Nebraska, New Mexico, Oklahoma, South
Their Carriers, W89-03316 5C	WARNER, J. W.	Dakota, Texas, and Wyoming,
	Recharge as Augmentation in the South Platte	W89-03030 2F
WANG, B. H.	Basin,	WEIL, L.
Design Problems in Gravel-Bed Rivers, Alaska, W89-02458 2J	W89-02482 4B	New System of Seepage Sampling for the Deter
	WARREN, S. G.	mination of Volatile Organic Substances (Neue
WANG, L. K.	Parameterization of Snow Albedo for Climate	System der Sickerwassergewinnung zur Bestim
BOD and Nutrient Removal by Biological A/O Process Systems,	Models, W89-02626 7C	mung Leichtfluchtiger Organischer Spuren stoffe),
W89-03326 5D		W89-03047 5A
Development of an Innovative and Cost-Effec-	Soot from Arctic Haze: Radiative Effects on the	
tive Municipal-Industrial Waste Treatment	Arctic Snowpack, W89-02611 2C	WEISS, E.
System,		Groundwater Flow in the Navajo Sandstone in Parts of Emery, Grand, Carbon, Wayne, Gar
W89-02960 5D	WATANABE, Y.	field, and Kane Counties, Southeast Utah,
Emissions and Control of Offensive Odor in	Reuse of Chemical Sludge for Conditioning of Biological Sludges,	W89-02521 2
Wastewater Treatment Plants,	W89-02815 5D	WEI DORN C T
W89-02962 5D		WELBORN, C. T. Effects of Runoff Controls on the Quantity an
Evaluation of Sodium Aluminate as a Coagulant	WATERS, R. A. Development and Field Use of a Snow Collec-	Quality of Urban Runoff at Two Locations i
for Cost Savings at Water Treatment Plants,	tor for Acid Precipitation Studies,	Austin, Texas,
W89-02959 5F	W89-02945 5B	W89-02518 5

Data on Groundwater Quality for the Caliente One Degree X Two Degree Quadrangle, East-	Implications of the Clean Water Act and Safe Drinking Water Act Legislation for Southwest-	pendiction of Results,
ern Nevada,	ern Indian Tribes: Water-Quality Management and Indian Self Determination,	W89-02932 2H
W89-02544 7C	W89-02334 5G	WHITTLE, I. R. Urban Flood Problems: Their Scale and the
Data on Groundwater Quality for the Elko 1 Degree X 2 Degree Quad ngle, Eastern Nevada,	WENZLAU, R. Role of Aquifer Testing in Design of Constant- Head Extraction Systems,	Policy Response, W89-02746 4A
W89-02534 7C	W89-02346 7B	WIECHERT, L. A.
Data on Groundwater Quality for the Ely 1 Degree X 2 Degree Quadrangle, Eastern	WERRITTY, A. Stream Response to Flash Floods in Upland	Estuarine Invertebrates and Fish: Sampling Design and Constraints for Long-Term Meas- urements of Population Dynamics,
Nevada, W89-02535 7C	Scotland, W89-02912 2E	W89-02327 2L
Data on Groundwater Quality for the Lovelock	WESTERMAN, R. L.	WIESMANN, U.
One Degree X Two Degree Quadrangle, Western Nevada, W89-02538 7C	Efficient Nitrogen Fertilization in Agricultural Production Systems,	Treatment of Filter Effluents from Dewatering of Sludges by a New High Performance Flocculation Reactor.
Data on Groundwater Quality for the Lund 1	W89-02665 5B	W89-02819 5D
Degree X 2 Degree Quadrangle, Eastern Nevada,	WESTERMANN, P. Toxicity of Heavy Metals to Thermophilic Anaerobic Digestion,	WIGGINS, B. A. Role of Protozoa in Microbial Acclimation for
W89-02536 7C	W89-02922 5D	Mineralization of Organic Chemicals in Sewage, W89-03283 5D
Data on Groundwater Quality for the McDer- mitt One Degree X Two Degree Quadrangle,	WETTER, L. H.	WIJESEKERA, A. G. N.
Northern Nevada, W89-02537 7C	Water Conservation for More Crop Production in the Great Plains,	Development of Groundwater Resources in Sri
Data on Groundwater Quality for the Millett 1	W89-02657 3F	Lanka, W89-02383 4B
Degree X 2 Degree Quadrangle, Central	WETZEL, R. G.	WILLIAMS, A. G.
Nevada, W89-02533 7C	Phosphorous Flux from Lake Sediments: Effect of Epipelic Algal Oxygen Production, W89-03248 2H	Hydrochemical Characteristics of a Dartmoor Hillslope,
Data on Groundwater Quality for the Reno One Degree X Two Degree Quadrangle, Western	WHEELER, B. D.	W89-02903 2E
Nevada,	Acidification and Succession in a Flood-Plain	WILLIAMS, D. E.
W89-02540 7C	Mire in the Norfolk Broadland, U.K., W89-03123 2H	Halamine Water Disinfectants, W89-03285 5F
Data on Groundwater Quality for the Southern Nevada Part of the Kingman One Degree X	WHEELER, G. A.	New Disinfection Agents for Water,
Two Degree Quadrangle, W89-02546 7C	Natural and Anthropogenic Acidification of Peatlands,	W89-02970 5F
Data on Groundwater Quality for the Tonopah	W89-02311 5B	WILLIAMS, D. F. Glacio-Eustatic Sea-Level Control on Red Sea
One Degree X Two Degree Quadrangle, Central Nevada,	WHELAN, G. Groundwater Assessment Modeling Under the	Salinity, W89-03119 2L
W89-02542 7C	Resource Conservation and Recovery Act, W89-02995 5B	
Data on Groundwater Quality for the Walker Lake One Degree X Two Degree Quadrangle,		WILLIAMS, J. F. Development of Groundwater Resources in the
Western Nevada and Eastern California, W89-02541 7C	WHILDEN, M. M. Floodplain Mapping and Beyond: A State Perspective.	Orange County Area, Texas and Louisiana, 1980-Spring of 1985,
Data on Groundwater Quality for the Western	W89-02755 6F	W89-02513 2F
Nevada Part of the Death Valley One Degree X Two Degree Quadrangle,	WHITE, D. A. Synoptic-Scale Assessment of Surface Runoff,	Groundwater Withdrawals and Changes in Groundwater Quality and Land Surface Subsid-
W89-02545 7C Data on Groundwater Quality for the Western	W89-02703 2E	ence in the Houston District, Texas, W89-02519 6G
Nevada Part of the Goldfield One Degree X Two Degree Quadrangle,	WHITE, W. R. Extremal Hypotheses Applied to River Regime,	Records of Wells, Drillers' Logs, Water Level
W89-02543 7C	W89-02454 2J	Measurements, and Chemical Analyses of Groundwater in Harris and Galveston Counties, Texas 1980-84,
Data on Groundwater Quality for the Winne- mucca One Degree X Two Degree Quadrangle,	WHITNEY, F. Change in Distribution Patterns of Photosynthe-	W89-02497 7C
Central Nevada, W89-02539 7C	tically Incorporated C during Phytoplankton Bloom in Controlled Experimental Ecosystem, W89-03059 2L	WILLIAMS, J. J. R. Mathematical Hydraulic Model of the River
WELCH, H. E. Emergence of Chironomidae (Diptera) in Fertil-	WHITTAKER, E. L.	Nene a Canalized, and Heavily Controlled River,
ized and Natural Lakes at Saqvaqjuac, N.W.T., W89-03216 2H	Two Test Procedures for Radon in Drinking Water: Interlaboratory Collaborative Study,	W89-03141 4A
WELLEMEYER, C. G.	W89-02956 5A	WILLIAMS, R. P. Data on Groundwater Quality for the Caliente
Nimbus-7 Global Cloud Climatology: Part I. Algorithms and Validation, W89-03307 2B	WHITTAKER, J. G. Sediment Transport in Step-Pool Streams,	One Degree X Two Degree Quadrangle, East- ern Nevada,
WELLS, D. E.	W89-02448 2J	W89-02544 7C
Extraction, Clean-up and Group Separation Techniques in Organochlorine Trace Analysis, W89-03068 5A	WHITTER, J. Use of Saline Water for Buffalo Gourd Production in New Mexico,	Data on Groundwater Quality for the Elko 1 Degree X 2 Degree Quadrangle, Eastern Nevada,
WELLS, J. G.	W89-02475 3C	W89-02534 7C
Hydrology of Area 62, Northern Great Plains and Rocky Mountain Coal Provinces-New Mexico and Arizona,	WHITTIER, T. R. Correspondence Between Ecoregions and Spa- tial Patterns in Stream Ecosystems in Oregon,	Data on Groundwater Quality for the Ely 1 Degree X 2 Degree Quadrangle, Eastern Nevada,
W89-02498 2F	W89-03223 2H	W89-02535 7C

WILLIAMS, R. P.

Data on Groundwater Quality for the Lovelock	WINDOM, H.	WONG, L. T. K.
One Degree X Two Degree Quadrangle, West-	Trace Metal Transport in a Tropical Estuary,	Bacterial Leaching of Heavy Metals from An-
ern Nevada,	W89-03276 2L	aerobically Digested Sludge,
W89-02538 7C	WINKLER, M. G.	W89-02925 5D
D. C. L. O. E. C. A. Y	Effect of Climate on Development of Two	
Data on Groundwater Quality for the Lund 1	Sphagnum Bogs in South-Central Wisconsin,	WONGSAWAT, S.
Degree X 2 Degree Quadrangle, Eastern	W89-03293 2H	Status of Hydrogeological Mapping in Thailand,
Nevada, W89-02536 7C	110703275	W89-02384 2F
W 65-02330	WINNARD, D. A.	
Data on Groundwater Quality for the McDer-	Trace Metal Speciation in Sediments and Soils:	WOOD, C. M.
mitt One Degree X Two Degree Quadrangle,	An Overview from a Water Industry Perspec-	Blood Gases, Acid-Base Status, Ions, and Hema-
Northern Nevada,	tive,	tology in Adult Brook Trout (Salvelinus fontina-
W89-02537 7C	W89-02651 5B	lis) Under Acid/Aluminum Exposure,
	MANAGET C	W89-03236 5C
Data on Groundwater Quality for the Millett 1	WINNETT, G. Characteristics of the Sorption of Chlorothalonil	
Degree X 2 Degree Quadrangle, Central	and Azinphos-Methyl to a Soil from a Commer-	Effects of Aluminum and Low pH on Net Ion
Nevada, W89-02533 7C	cial Cranberry Bog.	Fluxes and Ion Balance in the Brook Trout
W89-02533 7C	W89-03195 5B	(Salvelinus fontinalis),
Data on Groundwater Quality for the Reno One	1107-03173	W89-03235 5C
Degree X Two Degree Quadrangle, Western	WINTER, T. C.	
Nevada.	Hydrology and Chemistry of Selected Prairie	Effects of Low pH and Aluminum on Ventila-
W89-02540 7C	Wetlands in the Cottonwood Lake Area, Stuts-	tion in the Brook Trout (Salvelinus fontinalis),
	man County, North Dakota, 1979-82,	W89-03240 5C
Data on Groundwater Quality for the Southern	W89-03035 2H	
Nevada Part of the Kingman One Degree X	HITATERRO C	Long-Term Sublethal Acid Exposure in Rain-
Two Degree Quadrangle,	WINTERS, S.	bow Trout (Salmo gairdneri) in Soft Water:
W89-02546 7C	U.S. Production of Manufactured Gases: Assess-	Effects on Ion Exchanges and Blood Chemistry,
Data on Groundwater Quality for the Tonopah	ment of Past Disposal Practices, W89-02964 5E	W89-03226 5C
One Degree X Two Degree Quadrangle, Cen-	W 89-02904 JE	P4 - 1-1 - 1 PF - 14
tral Nevada,	WIPF, V. J.	Physiological Evidence of Acclimation to Acid/
W89-02542 7C	Drainage Areas in the James River Basin in	Aluminum Stress in Adult Brook Trout (Salve-
	Eastern South Dakota,	linus fontinalis): I. Blood Composition and Net
Data on Groundwater Quality for the Walker	W89-02515 7C	Sodium Fluxes,
Lake One Degree X Two Degree Quadrangle,		W89-03237 5C
Western Nevada and Eastern California,	WISEMAN, W. J.	Physical Publisher of Audio de Auddy
W89-02541 7C	Mobile Bay Estuary: Stratification, Oxygen De-	Physiological Evidence of Acclimation to Acid/
Data on Groundwater Quality for the Western	pletion, and Jubilees,	Aluminum Stress in Adult Brook Trout (Salve-
Nevada Part of the Death Valley One Degree X	W89-02696 2L	linus fontinalis): II. Blood Parameters by Cannu-
Two Degree Quadrangle,	WITHINGTON, D. B.	lation,
W89-02545 7C	Quality of Groundwater in Shallow Wells in	W89-03238 5C
	Agricultural Areas of Haywood, Shelby, Lake,	WOOD, E. F.
Data on Groundwater Quality for the Western	and Obion Counties, Tennessee, January-Febru-	
Nevada Part of the Goldfield One Degree X	ary 1988,	Model Calibration Based on Random Environ-
Two Degree Quadrangle,	W89-02557 5B	mental Fluctuations,
W89-02543 7C	11070257	W89-03105 7A
Date on Grandwater Quality for the Wines	WITMER, G. W.	WOOD I M
Data on Groundwater Quality for the Winne-	Cumulative Impact Assessment: Application of a	WOOD, J. M.
mucca One Degree X Two Degree Quadrangle, Central Nevada,	Methodology,	Transport, Bioaccumulation, and Toxicity of
W89-02539 7C	W89-02824 7C	Metals and Metalloids in Microorganisms under
1103-0233	WOFSY, S. C.	Environmental Stress,
WILLIAMS, R. S.	Biogenic Gases and the Oxidation and Reduc-	W89-02652 5B
Methods for Hydrologic Monitoring of Surface	tion of Carbon in Amazon River and Floodplain	WOODIN, S.
Mining in the Central-Western United States,	Waters,	
W89-02490 7A	W89-03247 2E	Responses to Acidic Deposition in Ombotrophic
WILLIAMS, R. T.	11 67-03247	Mires in the U.K.,
Land Treatment of Nitroguanidine Wastewater,	WOLANSKI, E.	W89-02314 5B
W89-02293 5D	Circulation Anomalies in Tropical Australian	WOODS, R. M.
	Estuaries,	Pollution Control Using Room Temperature
Tropical and Monsoonal Studies,	W89-02697 2L	Evaporators,
W89-02968 2B	WOLCOTT LE	W89-02400 5G
WILLOUGHBY, T. C.	WOLCOTT, J. F. Piver Bed Gravels: Sampling and Analysis	17 07*U2*UU
External Quality-Assurance Results for the Na-	River Bed Gravels: Sampling and Analysis, W89-02433 7B	WOODWARD, M. D.
tional Atmospheric Deposition Program and Na-	7B	Ground Water and Agriculture: Addressing the
tional Trends Network During 1986,	WOLFF, J.	Information Needs of Pennsylvania's Chesa-
W89-02463 7C	Processing Sediment Macrofauna Samples,	peake Bay Program,
11 05 05 105	W89-02765 7B	W89-02680 5G
WILSON, J. T.		W 89-02080 3G
Biodegradation Modeling at Aviation Fuel Spill	WOLFF, W. J.	WORD, J. Q.
Site,	Flora and Macrofauna of Intertidal Sediments,	Puget Sound: A Fjord System Homogenized
W89-03100 5G	W89-02763 2L	with Water Recycled over Sills by Tidal Mixing.
WILSON, R. E.	Remote Sensing,	W89-02694 2L
Dynamics of Partially Mixed Estuaries,	W89-02761 7B	11 07-02074 ZL
W89-02683 2L		WORLEY, S. D.
	WONG, C. S.	Halamine Water Disinfectants,
WILSON, S. B.	Change in Distribution Patterns of Photosynthe-	W89-03285 5F
In Situ Aquifer Denitrification: Remediation of		
Ammonia and Nitrate Contaminated Subsurface	Bloom in Controlled Experimental Ecosystem,	New Disinfection Agents for Water,
Environments,	W89-03059 2L	W89-02970 5F
W89-02359 5G	WONG, G. S.	31
WILSON, T. D.	Sulfate Resistance of Mortars Made Using Port-	WRENN, M. E.
Bibliography of U.S. Geological Survey Reports		Gastrointestinal Absorption of Soluble Uranium
on the Water Resources of Florida, 1886-1984,	Pozzolan or Slag,	from Drinking Water,
W90 03537 10C	\$1/90 00714	13/00 00007 ED

WRIGHT, R. F.	11N, 5. C. L.	ZARILIO, G. A.
Reversibility of Acidification Shown by Whole-	Modeling Groundwater Transport of Dissolved	Sediment Transport Prediction in a Tidal Inlet
Catchment Experiments,	Gasoline and Using the Results to Evaluate Aq-	Using a Numerical Model: Application to Stony
W89-03120 5B	uifer Restoration Processes,	
W 67-03120		Brook Harbor, Long Island, New York, USA,
WU, B. C.	W89-03321 5B	W89-03185 2J
Recent Advances in Magnetic Processes,	YOHE, T. L.	TATION W. C.
W89-02961 5D	Pretreatment of Drinking Water to Control Or-	ZAUGG, W. S.
		Copper Intoxication in Chinook Salmon (Oncor-
XU, Y.	ganic Contaminants and Taste and Odor,	hynchus Tshawystscha) Induced by Natural
Fate and Effects of Xanthates in Laboratory	W89-02793 5F	Springwater: Effects on Gill Na(+), K(+)-
Freshwater Systems,		
	YOKSAS, T. C.	ATPase, and Plasma Glucose,
W89-03201 5G	Estimate of Precipitation Enhancement Potential	W89-03228 5C
YAMADA, M.	for the Duero Basin of Spain,	70140 7
Xanthene Dye Chemiluminescence for Determi-	W89-03306 3B	ZHAO, Z.
nation of Free Chlorine in Water,		Relationships between Snow Cover and Tem-
W89-03183 7B	YOUNG, C. E.	perature in the Lower Troposphere, General
1107-03103	Managing Farm Nutrients: Tradeoffs for Sur-	Circulation in East Asia and Precipitation in
YAN, B. R.		
	face- and Ground-Water Quality,	China,
Investigation into Mechanisms of Microbial Ef-	W89-02833 5G	W89-02609 2C
fects on Iron and Manganese Transformations in		
Artificially Recharged Groundwater,	YOUNG, C. T.	CHICATORIC W
W89-03078 4B	Energy Dissipation Rate Approach in River Me-	ZHICHENG, K.
W 67-03076 4D		Analysis of Sediment Transport by Debris
VANC I V	chanics,	Flows in the Jiangjia Gully, Yunnan,
YANG, J. Y.	W89-02453 2J	
Modeling of Polychlorinated Biphenyls in		W89-02909 21
Vadose Zone,	YOUNG, D. N.	
W89-02353 5B		ZHU, X.
11 07 02000	Pilot-Scale Anaerobic Biomass Acclimation	
YAREMKO, E. K.	Studies with a Coal Liquefaction Wastewater,	Water Quality Problems and Control Strategies
River Bed Scour and Construction of Stone	W89-02297 5D	for the Water Supply of Tianjin City,
		W89-02794 51
Riprap Protection,	YOUNG, H. W.	W 02-06124
W89-02442 8A		
	Selected Water-Quality Data for the Murtaugh	ZIECHMAN, W.
YEAGER, B. L.	Lake Area, South Central Idaho, June 1987,	Interactions of Organic Matter and Aluminum
Effects of Aeration and Minimum Flow En-	W89-02530 7C	Ions in Acid Forest Soil Solutions: Metal Com
hancement on the Biota of Norris Tailwater,	YURTSEVER, Y.	plexation, Flocculation, and Precipitation,
W89-02826 5G		W89-03126 21
	Use of Linear Compartmental Simulation Ap-	1107-03120
YEH, G. T.	proach for Quantitative Interpretation of Isotope	### ##################################
Lagrangian-Eulerian Approach to Modeling Hy-	Data under Time Variant Flow Conditions,	ZIMMERMAN, J. T. F.
drogeochemical Transport of Multi-Component	W89-03017 7C	Estuarine Residence Times,
	W89-03017	
Systems,		W89-02688 21
W89-03320 5B	ZACHARA, J. M.	
	Influence of Cosolvents on Quinoline Sorption	ZOUBOULIS, I.
YEH, H. Y. M.	by Subsurface Materials and Clays,	Separation of Heavy Metals from Effluents b
Nimbus-7 Global Cloud Climatology: Part I.		
	W89-03040 5B	Flotation,
Algorithms and Validation,		W89-02803 51
W89-03307 2B	ZAGHLOUL, H. H.	
	Economic Evaluation of Air Stripping to	TIPED A
YEH, J.		ZUBER, A.
Modeling the Response of Lake-Aquifer Sys-	Remove Volatile Organic Compounds from	Review of Existing Mathematical Models for
tems to Acid Precipitation.	Water,	Interpretation of Tracer Data in Hydrology,
	W89-02976 5F	
W89-02341 5C		W89-03012 2
	ZANDEE, D. I.	
YEH, T. C. J.	TOTAL COLLEGE TO THE POST OF THE PERSON OF T	ZUEHLS, E. E.
Modeling the Response of Lake-Aquifer Sys-	Effects of Cadmium Exposure on Feeding of	
tems to Acid Precipitation,	Freshwater Planktonic Crustaceans,	Hydrology of Area 27, Eastern Region, Interio
	*****	Coal Province, Illinois,
W89-02341 5C		W89-02484 5
**************************************	Effects of Codminus on Communities Assisting	11 07 02 101
YELIGAR, M. B.	Effects of Cadmium on Consumption, Assimila-	77 1 1 1
Metal Finishing Wastewater Treatment Upgrade	tion and Biochemical Parameters of Daphnia	Hydrology of Area 31, Eastern Region, Interio
with an Insoluble Sulfide Precipitation Process,		Coal Province, Illinois and Indiana,
W89-02402 5D		W89-02508 5
H 07-02-102 3D	W 07-03207	77 02 000



AALBORG UNIVERSITETSCENTER (DENMARK), ENVIRONMENTAL ENGINEERING LAB,	Role of Phenolic and Humic Compounds in Anaerobic Digestion Processes, W89-02924 5D	AMSTERDAM UNIV. (NETHERLANDS), LAB. FOR PHYSICAL GEOGRAPHY AND SOIL SCIENCE,
Hydrogen Sulphide Control in Municipal	W 07-02724	Surface and Subsurface Sources of Suspended
Sewers, W89-02810 5D	AIR FORCE GEOPHYSICS LAB., HANSCOM AFB, MA.	Solids in Forested Drainage Basins in the Keuper Region of Luxembourg,
ABERDEEN UNIV. (SCOTLAND). DEPT. OF	Cumulus and Thunderstorm Initiation by Moun- tains.	W89-02892 2J
SOIL SCIENCE. Acidification of Freshwaters,	W89-02787 2B	Sources of Variation of Soil Erodibility in
W89-02774 5B	ATR EODGE INST. OF TEGH. NIDIGHT	Wooded Drainage Basins in Luxembourg, W89-02893 2J
ACADEMIA CINICA DELING (CHINA)	AIR FORCE INST. OF TECH., WRIGHT- PATTERSON AFB, OH. SCHOOL OF	W 89-02893
ACADEMIA SINICA, BEIJING (CHINA). INST. OF GEOGRAPHY.	ENGINEERING.	ANEPTEK CORP., WAYLAND, MA.
Geological Structure: An Important Factor	Simulations of Physical Nonequilibrium Solute	Waste Treatment and Recycling of Mixed Wastewater from a Metal Finishing Company,
Controlling Karst Development, W89-02733 2F	Transport Models: Application to a Large-Scale Field Experiment,	W89-02408 5D
	W89-03148 2F	
ACADEMIA SINICA, LANZHOU (CHINA). LANZHOU INST. OF GLACIOLOGY AND	AND HODGE OCCUPATIONAL AND	APPLIED RESEARCH CORP., LANDOVER, MD.
CRYOPEDOLOGY.	AIR FORCE OCCUPATIONAL AND ENVIRONMENTAL HEALTH LAB., BROOKS	Satellite Rainfall Retrieval by Logistic Regres-
Distribution of Snow Cover in China,	AFB, TX.	sion,
W89-02613 2C	Wastewater Characterization and Hazardous	W89-02854 7C
ACADEMY OF NATURAL SCIENCES OF	Waste Survey, Castle AFB, CA, W89-02704 5D	AQUATEAM-NORWEGIAN WATER
PHILADELPHIA, PA. DIV. OF ENVIRONMENTAL RESEARCH.	W 03-02104	TECHNOLOGY CENTRE OF OSLO
Denitrification in Freshwater and Coastal	ALABAMA MARINE RESOURCES LAB.,	(NORWAY).
Marine Ecosystems: Ecological and Geochemi-	DAUPHIN ISLAND. Mobile Bay Estuary: Stratification, Oxygen De-	Pretreatment of Sludge Liquors in Sewage Treatment Plants,
cal Significance, W89-03256 2H	pletion, and Jubilees,	W89-02817 5D
	W89-02696 2L	ABOTTO DIOLOGICAL OFATION OFF AND
ACRES INTERNATIONAL LTD., NIAGARA	AND AND ADDRESS OF A STATE OF A S	ARCTIC BIOLOGICAL STATION, STE. ANNE DE BELLEVUE (OUEBEC).
FALLS, NY. Hydrologic Design Methodologies for Prefeasi-	ALBANY MUSEUM, GRAHAMSTOWN (SOUTH AFRICA).	Influence of a River Plume on the Sea-ice Meio-
bility Studies of Small-Scale Hydro at Ungauged	Research and Information Needs,	fauna in South-eastern Hudson Bay,
Sites, W89-03129 7A	W89-02993 2H	W89-03189 2L
W69-03129	ALBERTA ENVIRONMENT, EDMONTON.	ARGONNE NATIONAL LAB., IL.
AGRICULTURAL RESEARCH	STANDARDS AND APPROVALS DIV.	BIOLOGICAL, ENVIRONMENTAL, AND
ORGANIZATION, BET-DAGAN (ISRAEL). VOLCANI CENTER.	Effect of pH on Speciation and Toxicity of	MEDICAL RESEARCH DIV. Effects on Suspended and Substrate Sediments
Effect of Activated Sludge in the Breeder Diet	Aluminum to Rainbow Trout (Salmo gairdneri), W89-03213 5C	in Two Streams Resulting from Different Gas-
on the Reproduction Criteria and the Perform-	W 89-03213	Pipeline Installation Techniques,
ance of their Offspring, W89-03061 5E	ALBERTA ENVIRONMENTAL CENTRE,	W89-02823 4C
A CIDICAL PRINTED AT INDICAL PRINTED	VEGREVILLE. Organic Chemicals in Natural Waters: Applied	Nonparametric Evaluation of the Size of Limno-
AGRICULTURAL RESEARCH SERVICE, BELTSVILLE, MD. SOIL-MICROBIAL	Monitoring and Impact Assessment,	logical Sampling Networks: Application to the
SYSTEM LAB.	W89-02776 5C	Design of a Survey of Green Bay, W89-03174 7A
Metal Speciation and Interactions among Ele- ments Affect Trace Element Transfer in Agri-	ALDEDTA UNIV EDMONTON DEPT OF	
cultural and Environmental Food-Chains,	ALBERTA UNIV., EDMONTON. DEPT. OF MICROBIOLOGY.	ARGONNE NATIONAL LAB., IL. ENERGY
W89-02650 5B	Anaerobic Degradation of Phenolic Compounds	AND ENVIRONMENTAL SYSTEMS DIV. Cumulative Impact Assessment: Application of a
AGRICULTURAL RESEARCH SERVICE,	with Applications to Treatment of Industrial	Methodology,
BUSHLAND, TX.	Waste Waters, W89-02918 5D	W89-02824 7C
U.S.D.A. Agricultural Research Service Com- mitment to Ground Water Research,		Effects of Gas-Pipeline Construction on the
W89-02655 3F	ALBERTA UNIV., EDMONTON. DEPT. OF	Aquatic Ecosystem of Canada Creek, Presque
ACRICULTURAL RECEARCII CERVICE	ZOOLOGY. Comparison of In Situ Estimates of Chlorophyll	Isle County, Michigan, W89-02861 40
AGRICULTURAL RESEARCH SERVICE, DURANT, OK.	a Obtained with Whatman GF/F and GF/C	W89-02861 4C
Nitrogen and Ground Water Protection.	Glass-Fiber Filters in Mesotrophic to Hypereu-	Cumulative Impact Assessment: Issues to Con
W89-02679 5G	tophic Lakes, W89-03217 7B	sider in Selecting a Cumulative Assessmen
AGRICULTURAL RESEARCH SERVICE, EL		Method, W89-02965 50
RENO, OK. Behavior And Subsurface Transport of Agro-	ALIGARH MUSLIM UNIV. (INDIA). DEPT.	
chemicals in Conservation Systems,	OF BIOLOGY. Movement of Carbofuran (Nematicide) in Soil	Modeling Groundwater Transport of Dissolver Gasoline and Using the Results to Evaluate Aq
W89-02667 5B	Columns,	uifer Restoration Processes.
AGRICULTURAL UNIV., WAGENINGEN	W89-03297 5B	W89-03321 51
(NETHERLANDS). DEPT. OF SOIL SCIENCE	AMERICAN ELECTROPLATERS AND	ARIZONA DEPT. OF ENVIRONMENTAL
AND GEOLOGY.	SURFACE FINISHERS SOCIETY, ORLANDO,	QUALITY, PHOENIX.
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erlands as a Result of Acid Deposition,	8th AESF/EPA Conference on Pollution Con- trol for the Metal Finishing Industry.	er Management in Arizona, W89-02336 4
W89-02309 5B	W89-02392 5G	TT 07-02330
AGRICULTURAL UNIV., WAGENINGEN		Dry Wells - Solution or Pollution: An Arizon
(NETHERLANDS), DEPT. OF WATER	AMERICAN SOCIETY OF CIVIL ENGINEERS, NEW YORK, TASK	Status Report, W89-02338 5
POLLUTION CONTROL. Microbial, Chemical, and Technological Aspects	COMMITTEE ON BELT FILTER PRESSES.	11 07-02530 S
of the Anaerobic Degradation of Organic Pollut-	Belt Filter Press Dewatering of Wastewater	Statewide Groundwater Quality Monitorin
ants, W89-02920 5D	Sludge. W89-03099 5D	Network Design, W89-02343 5a
1107-02720	11 07 03077	

ARIZONA DEPT. OF ENVIRONMENTAL QUALITY, PHOENIX.

Random Survey of VOC's, Pesticides and Inor- ganics in Arizona's Drinking Water Wells,	Martins Fork Lake Sedimentation Study: Hy- draulic Model Investigation,	Influence of Cosolvents on Quinoline Sorption by Subsurface Materials and Clays,
W89-02344 5A	W89-02780 2J	W89-03040 5B
ARIZONA GAME AND FISH DEPT., PHOENIX.	New Haven Harbor Numerical Model Study, W89-02874 6G	Rationale for the Design of Monitoring Well Screens and Filter Packs,
Effects of Steady versus Fluctuating Flows on Aquatic Macroinvertebrates in the Colorado	I-664 Bridge-Tunnel Study, Virginia Sedimenta-	W89-03332 5B
River below Glen Canyon Dam, Arizona,	tion and Circulation Investigation,	DAVED A C TEVEDILICEN (CEDMANU
W89-02940 6G	W89-02875 4C	BAYER A.G., LEVERKUSEN (GERMANY, F.R.). PLASTICS AND COATINGS DIV.
ARIZONA UNIV., TUCSON. Toward Sustaining a Desert Metropolis: Water	NAPAP Operating Research Plan: 1986-1988. W89-02876 5B	Critical Assessment of the 'Dynamic Daphnia Test' (Kritische Betrachtung des 'Dynamischen
and Land Use in Tucson, Arizona, W89-02637 6D	Temperature Analysis, Howard A. Hanson Reservoir, Washington: Mathematical Model Inves-	Daphnien Tests'), W89-03046 5A
ARIZONA UNIV., TUCSON. DEPT. OF	tigation,	BAYERISCHES LANDESAMT FUER
CHEMISTRY. Ultra-Trace-Level Determination of Cobalt,	W89-02877 2H	WASSERWIRTSCHAFT, MUNICH
Chromium, and Hydrogen Peroxide by Luminol	ARMY ENGINEER WATERWAYS	(GERMANY, F.R.). Project Appraisal, Resource Allocation and
Chemiluminescence Detected With a Charge- Coupled Device,	EXPERIMENT STATION, VICKSBURG, MS. STRUCTURES LAB.	Public Involvement,
W89-03181 7B	Sulfate Resistance of Mortars Made Using Port-	W89-02758 6E
ARMY ENGINEER DISTRICT, NEW	land Cement and Blends of Portland Cement and Pozzolan or Slag,	BEAK CONSULTANTS LTD., BRAMPTON
ORLEANS, LA. Clam Shell Dredging in Lakes Pontchartrain	W89-02714 8F	(ONTARIO).
and Maurepas, Louisiana,	ARMY TOXIC AND HAZARDOUS	Bacterial Loadings from Resuspended Sediments in Recreational Beaches,
W89-02715 6G	MATERIALS AGENCY, ABERDEEN	W89-03136 5B
ARMY ENGINEER DISTRICT, PORTLAND,	PROVING GROUND, MD. Plating Waste Sludge Metal Recovery,	REDECIDE INCT. OF OCEANOCH AND
OR. Spirit Lake, Mount St. Helens, Washington,	W89-02395 5D	BEDFORD INST. OF OCEANOGRAPHY, DARTMOUTH (NOVA SCOTIA). DEPT. OF
Limnological and Bacteriological Investigations.	ATMOSPHERIC AND ENVIRONMENTAL	FISHERIES AND OCEANS.
Final Report, Volume I, W89-02709 2H	RESEARCH, INC., CAMBRIDGE, MA. Review of 183 GHz Moisture Profile Retrieval	Modeling of Tidally Induced Residual Currents, W89-02690 2L
Spirit Lake, Mount St. Helens, Washington,	Studies, W89-02705 7C	BEDFORD INST. OF OCEANOGRAPHY,
Limnological and Bacteriological Investigations. Final Report, Volume II, Appendices,		DARTMOUTH (NOVA SCOTIA). MARINE
W89-02710 2H	ATOMIC ENERGY OF CANADA LTD., CHALK RIVER (ONTARIO), CHALK RIVER	Production and Use of Detritus in Various
ARMY ENGINEER DISTRICT, ROCK	NUCLEAR LABS.	Freshwater, Estuarine, and Coastal Marine Eco-
ISLAND, IL. Definite Project Report for Section 14. Emer-	Pu(239,240) Residence Times in Freshwaters and Accumulation in Shield Lake Sediments,	systems, W89-03266 2H
gency Streambank Protection, Sangamon River	W89-03209 2H	
Sewage Treatment Facility, Riverton, Illinois. W89-02934 4D	AUBURN UNIV., AL.	Applicability of Fish Yield Indices in Freshwa- ter and Marine Ecosystems,
	New Disinfection Agents for Water, W89-02970 5F	W89-03270 2H
ARMY ENGINEER DISTRICT, ST. PAUL, MN. Souris River Basin Project, Saskatchewan,		PETANG INTER COUNTY OF THE CO
Canada - North Dakota, U.S.A. General Plan	AUBURN UNIV., AL. DEPT. OF CHEMISTRY. Halamine Water Disinfectants,	BEIJING UNIV. (CHINA), DEPT. OF GEOPHYSICS.
Report and Draft Environmental Impact State- ment.	W89-03285 5F	Relationships between Snow Cover and Tem-
W89-02937 8A	AUSTRALIAN INST. OF MARINE SCIENCES.	perature in the Lower Troposphere, General Circulation in East Asia and Precipitation in
Watertown, Minnesota: Flood Proofing Infor-	TOWNSVILLE, DEPT. OF PHYSICAL	China,
mation. W89-02939 6F	OCEANOGRAPHY. Circulation Anomalies in Tropical Australian	W89-02609 2C
	Estuaries,	BEMIDJI STATE UNIV., MN. CENTER FOR
ARMY ENGINEER DIV. SOUTHWESTERN, DALLAS, TX.	W89-02697 2L	ENVIRONMENTAL STUDIES.
Annual Report, 1986 (Reservoir Control Center,	BAKER BROTHERS/SYSTEMS,	Quantitative Studies of Biodegradation of Petro- leum And Some Model Hydrocarbons in
Southwestern Division, U.S. Army Corps of En- gineer).	STOUGHTON, MA. Electrolytic Recovery Theory, Application, Ad-	Ground Water and Sediment Environments,
W89-02716 4A	vantages,	W89-02674 5B
ARMY ENGINEER WATERWAYS	W89-02407 5D	BEN-GURION UNIV. OF THE NEGEV, SDE
EXPERIMENT STATION, VICKSBURG, MS.	BANGLADESH MINERAL EXPLORATION	BOKER (ISRAEL), JACOB BLAUSTEIN INST. FOR DESERT RESEARCH.
ENVIRONMENTAL LAB. Contrasting Diel Patterns of Vertical Migration	Water-Bearing Zones in the Mining Area of the	Role of Tracer Methods in Hydrology as a
in the Dinoflagellate Ceratium hirundinella in	Northern Region of Bangladesh with Regard to	Source of Physical Information: Basic Concepts and Definitions, Time Relationship in Dynamic
Relation to Phosphorus Supply in a North Tem- perate Reservoir,	Utilization of Mine Water for Irrigation and Other Uses,	Systems,
W89-03221 2H	W89-02369 2F	W89-03010 7B
ARMY ENGINEER WATERWAYS	BATTELLE COLUMBUS DIV., OH.	Biological Groundwater Denitrification: Labo-
EXPERIMENT STATION, VICKSBURG, MS. HYDRAULICS LAB.	Evaluation of Municipal Solid Waste Landfill Cover Designs,	ratory Studies,
Air Demand and Conduit Pressures, Stillhouse	W89-02871 5E	W89-03096 5F
Hollow Dam, Lampasas River, Texas, W89-02415 8B	BATTELLE PACIFIC NORTHWEST LABS.,	BIHAR UNIV., MUZAFFARPUR (INDIA).
	RICHLAND, WA.	DEPT. OF ZOOLOGY.
Blountstown Reach, Apalachicola River, Mova- ble-Bed Model Study,	Groundwater Assessment Modeling Under the Resource Conservation and Recovery Act,	Sensitivity of Branchial Mucus to Crude Oil Toxicity in a Freshwater Fish, Colisa fasciatus,
W89-02416 2J	W89-02995 5B	W89-03204 5C

BIRMINGHAM UNIV. (ENGLAND), DEPT. OF CIVIL ENGINEERING.	Problems of the Toxicological Compatibility of Hydrogen Peroxide in Drinking and Swimming	CALIFORNIA UNIV., BERKELEY. DEPT. OF AGRICULTURAL AND RESOURCE
Groundwater Flow through a Miliolite Lime-	Pool Water for Humans from the Pharmacokine-	ECONOMICS.
stone Aquifer, W89-03050 2F	tic and Biochemical Points of View (Probleme Der Humantoxikologischen Vertraglichkeit von	Incentives and Institutions to Reduce Pesticide Contamination of Ground Water,
BOLIDEN KEMI A.B., STOCKHOLM	Wasserstoffperoxid in Bade- and Trinkwasser aus Biochemischer und Pharmakokinetischer	W89-02677 5G
(SWEDEN).	Sicht),	CALIFORNIA UNIV., BERKELEY, DEPT. OF
Pre-Precipitation for Improvement of Nitrogen Removal in Biological Wastewater Treatment,	W89-03042 5C	CIVIL ENGINEERING.
W89-02812 5D	Microbial Activity in Sanitary Landfills: A Pos- sible Source of the Humic Substances in	Review of the State of the Art for Underwater Repair Using Abrasion-Resistant Concrete.
BOYCE THOMPSON INST. FOR PLANT	Groundwater,	W89-02781 8F
RESEARCH, ITHACA, NY.	W89-03079 5B	
Effects of Ozone and Acid Rain on White Pine (Pinus strobus) Seedlings Grown in Five Soils:	Biological Degradation of Volatile Chlorinated	CALIFORNIA UNIV., DAVIS.
III. Nutrient Relations,	Hydrocarbons in Groundwater,	Central Valley of California, W89-02633 6D
W89-03058 5C	W89-03081 5B	
BP PETROLEUM DEVELOPMENT LTD.,	BUREAU OF INDIAN AFFAIRS, ALBUQUERQUE, NM. ALBUQUERQUE	CALIFORNIA UNIV., DAVIS. DEPT. OF BOTANY.
ABERDEEN (SCOTLAND). Macrofauna of Subtidal Sediments Using	AREA OFFICE.	Hurricane-Induced Sediment Deposition in a
Remote Sampling,	Implications of the Clean Water Act and Safe	Gulf Coast Marsh,
W89-02764 2L	Drinking Water Act Legislation for Southwest- ern Indian Tribes: Water-Quality Management	W89-03193 2J
Processing Sediment Macrofauna Samples,	and Indian Self Determination,	CALIFORNIA UNIV., LOS ANGELES.
W89-02765 7B	W89-02334 5G	Great American Desert Transformed: Aridity,
DRANDER (D. I.) CO. ALICTEN TV	BUREAU OF LAND MANAGEMENT,	Exploitation, and Imperialism in the Making of
BRANDES (R.J.) CO., AUSTIN, TX. Ouantity and Quality of Recharge to the Ogal-	ROSEBURG, OR.	the Modern American West,
lala Aquifer from Urban Runoff,	Peak/Risk/Culvert: A Program to Compute Peak Flows, Hydrologic Risk, and Circular Cul-	W89-02632 6D
W89-02340 4C	vert Sizes at Forest Road Crossings,	CALIFORNIA UNIV., RICHMOND.
BRISTOL UNIV. (ENGLAND).	W89-02831 2E	EARTHQUAKE ENGINEERING RESEARCH
Flood Inundation Modelling Using MILHY,	BUREAU OF MINERAL RESOURCES,	CENTER.
W89-03330 2E	GEOLOGY AND GEOPHYSICS, CANBERRA	Dynamic Reservoir Interaction with Monticello Dam.
Modelling Seasonally Freezing Ground Condi-	(AUSTRALIA). Assessment and Mapping of Australia's Ground-	W89-02848 8A
tions,	water Resources,	
W89-03331 2C	W89-02365 2F	CALIFORNIA UNIV., RICHMOND.
BRISTOL UNIV. (ENGLAND). DEPT. OF	BUREAU OF MINES AND GEO-SCIENCES,	SANITARY ENGINEERING AND ENVIRONMENTAL HEALTH RESEARCH
GEOGRAPHY. Controls on the Composition of Authigenic Per-	MANILA (PHILIPPINES).	LAB.
colation Water in the Burren, Ireland,	Hydrogeological Mapping in the Philippines, W89-02382 2F	Strategies for Long-Term Pollution Monitoring
W89-02730 2K	W 67-02362	of the Coastal Oceans, W89-02319 5A
Controls on Overland Floor Conception	BUREAU OF RECLAMATION, DENVER, CO.	W89-02319 5A
Controls on Overland Flow Generation, W89-02882 2E	ENGINEERING AND RESEARCH CENTER. Energy Dissipation Rate Approach in River Me-	CALIFORNIA UNIV., RIVERSIDE.
	chanics,	Growth and Water in the South Coast Basin of
BRITISH COLUMBIA UNIV., VANCOUVER. DEPT. OF GEOGRAPHY.	W89-02453 2J	California,
River Bed Gravels: Sampling and Analysis,	C3 INTERNATIONAL, INC., ST. PAUL, MN.	W89-02636 6D
W89-02433 7B	Membrane Separation Processes for Industrial	CALIFORNIA UNIV., SANTA BARBARA.
Experimental Method in Geomorphology,	Effluent Treatment, W89-02806 5D	Remote Sensing of Snow Properties in Moun-
W89-02913 2E		tainous Terrain,
	CADIZ UNIV. (SPAIN), DEPT. OF	W89-02624 7B
BRITISH GEOLOGICAL SURVEY, KEYWORTH (ENGLAND).	CHEMICAL ENGINEERING. Thermophilic Anaerobic Digestion of Winery	CALIFORNIA UNIV., SANTA BARBARA.
Distribution of Gamma-emitting Radionuclides	Waste (Vinasses): Kinetics and Process Optimi-	DEPT. OF BIOLOGICAL SCIENCES.
in Surface Subtidal Sediments Near the Sella-	zation, W89-03114 5D	Survey of Sensitivity of Southern California
field Plant, W89-03190 5B	W07-03114	Lakes to Acid Deposition, W89-02864 50
	CALGARY UNIV. (ALBERTA). AQUATIC	W89-02864 5C
BUDERUS A.G., WETZLAR (GERMANY, F.R.).	ECOLOGY SECTION. Contrasting Patterns of Net- and Nanoplankton	Interpretation of 'Controlled' vs 'Natural' Ex-
Separators and Emulsion Separation Systems for Petroleum, Oil, and Lubricants,	Production and Biomass Among Lakes,	periments in Streams,
W89-02808 5D	W89-03218 2H	W89-03117 7A
BUNDESANSTALT FUER	CALGARY UNIV. (ALBERTA), DEPT. OF	Indirect Effects and Biological Control of Mos
GEOWISSENSCHAFTEN UND ROHSTOFFE,	BIOLOGY. Effects of Low pH and Aluminum on Ventila-	quitoes by Mosquitofish
HANOVER (GERMANY, F.R.).	tion in the Brook Trout (Salvelinus fontinalis),	
International Legend for Hydrogeological Maps: Principles and Application,	W89-03240 5C	
W89-02386 7B	CALIFORNIA STATE WATER RESOURCES	CALIFORNIA UNIV., SANTA BARBARA. MARINE SCIENCE INST.
	CONTROL BOARD, SACRAMENTO.	Chemical and Biological Survey of Lakes and
Data Requirements for Hydrogeological Maps, W89-02387 7A	Pretreatment for Wastewater Reclamation and	Streams Located in the Emerald Lake Water
W 07-02307 /A	Reuse, W89-02820 5D	shed, Sequoia National Park,
BUNDESGESUNDHEITSAMT, BERLIN		W89-02852 2F
(GERMANY, F.R.). INST. FUER WASSER-, BODEN- UND LUFTHYGIENE,	CALIFORNIA UNIV., BERKELEY. COLL. OF	CAMBRIDGE UNIV. (ENGLAND). DEPT. OF
Chemical Treatment of Flue Gas Washing Liq-	ENGINEERING. Residual Strength of Sand From Dam Failures	ZOOLOCY
uids,	in the Chilean Earthquake of March 3, 1985,	Coastal Lagoons of East Anglia, U.K.,
W89-02809 5D	W89-02851 8D	W89-03184 21

CANADIAN CLIMATE CENTRE, DOWNSVIEW (ONTARIO).

CANADIAN CLIMATE CENTRE, DOWNSVIEW (ONTARIO).	CHALMERS UNIV. OF TECHNOLOGY, GOETEBORG (SWEDEN). DEPT. OF	Case Study of Minimum Streamflow for Fishery Habitat in the Yampa River,
Snow Surveying in Canada,	GEOLOGY.	W89-02460 2J
W89-02614 7B	Clogging Problems in Groundwater Heat Pump	
Potential Impacts of a Scenario of CO2-Induced	Systems in Sweden, W89-03089 2F	Recharge as Augmentation in the South Platte
Climatic Change on Ontario, Canada,		Basin, W89-02482 4B
W89-03063 2A	CHEMISCHE FABRIK STOCKHAUSEN	1107-02-102
CANTEDDIDY INTO CUDICTCHIDCH	G.M.B.H., KREFELD (GERMANY, F.R.). Polyelectrolytes for the Treatment of Tap and	COLORADO STATE UNIV., FORT COLLINS.
CANTERBURY UNIV., CHRISTCHURCH (NEW ZEALAND), DEPT. OF CIVIL	Filter Back Washing Water,	DEPT. OF EARTH RESOURCES.
ENGINEERING.	W89-02797 5F	Sediment Supply, Movement and Storage in an Unstable Gravel-Bed River,
Static Armour Layers by Selective Erosion,		W89-02436 2J
W89-02439 2J	CHEN AND ASSOCIATES, DENVER, CO. Design and Construction of a Subsurface Gaso-	11 07 02 13 0
CAPE TOWN UNIV. (SOUTH AFRICA). DEPT.	line Recovery System Westminster, Colorado,	COLORADO STATE UNIV., FORT COLLINS.
OF ZOOLOGY.	W89-02357 5G	WATER RESOURCES RESEARCH INST.
Riverine Ecosystems,	CHENCOLI DICE OF COOCDADILY (CHINA)	Fiscal Year 1986 Program Report (Colorado Water Resources Research Institute),
W89-02986 2H	CHENGDU INST. OF GEOGRAPHY (CHINA). Analysis of Sediment Transport by Debris	W89-02477 9D
CARIBBEAN RESEARCH INST., ST.	Flows in the Jiangjia Gully, Yunnan,	
THOMAS, VI. WATER RESOURCES	W89-02909 2J	COLORADO UNIV. AT BOULDER. DEPT. OF
RESEARCH CENTER. Fiscal Year 1986 Program Report (Virgin Is-	CHICAGO DEPT. OF WATER, IL. WATER	GEOGRAPHY. Parameterization of Snow Albedo for Climate
lands Water Resources Research Center),	QUALITY SURVEILLANCE SECTION.	Models.
W89-02588 9D	Lake Michigan Water Quality Report January	W89-02626 7C
CECOS DEEDNISHOULD DISC DIFFELLO	through December, 1986. W89-02867 5B	
CECOS INTERNATIONAL, INC., BUFFALO, NY.	W 65-02807	COLORADO UNIV. AT COLORADO SPRINGS, DEPT. OF GEOGRAPHY AND
Treatment of Hazardous Wastes in a Sequencing	CINCINNATI WATER WORKS, OH.	ENVIRONMENTAL STUDIES.
Batch Reactor,	Geomembrane Liner Reduces Leakage in Un-	Warning Dissemination and Response with
W89-02917 5D	derground Reservoir, W89-03281 5F	Short Lead Times,
CENTRAAL INST, VOOR		W89-02754 6F
VOEDINGSONDERZOEK TNO, ZEIST	CITY OF LONDON POLYTECHNIC	COLORADO UNIV., BOULDER,
(NETHERLANDS). TOXICOLOGICAL	(ENGLAND). BIOLOGICAL SCIENCES. Natural History of Lakes,	Water Resources of the Upper Colorado River
ANALYSIS DEPT.	W89-02775 2H	Basin: Problems and Policy Alternatives,
Capillary Gas Chromatographic Determination of Amitrole in Water with Alkali Flame Ioniza-		W89-02635 6D
tion Detection,	CITY UNIV. OF NEW YORK. Influence of Ground Water on Soil-Structure	COLUMBIA NATIONAL FISHERIES
W89-03287 5A	Interaction,	RESEARCH LAB., MO.
CENTRAL COLORADO WATER	W89-02850 2F	Gas Chromatographic Residue Patterns of Toxa-
CONSERVANCY DISTRICT, GREELEY.	CLARKSON UNIV., POTSDAM, NY. DEPT.	phene in Fish Samples from the Great Lakes and
Conjunctive Use of Surface and Ground Water	OF CIVIL AND ENVIRONMENTAL	from Rivers of the Southeastern United States,
in the South Platte, River Basin: A Case Study	ENGINEERING.	W89-02328 5B
of the Central Colorado Water Conservancy District,	Reactions and Transport of Trace Metals in	COMMISSION OF THE EUROPEAN
W89-02659 6D	Groundwater, W89-02644 5B	COMMUNITIES, BRUSSELS (BELGIUM).
	707-02-044	COMMUNITY BUREAU OF REFERENCE.
CENTRAL FLORIDA RESEARCH AND EDUCATION CENTER, SANFORD, FL.	CLEMSON UNIV., SC. DEPT. OF	Determination of Traces of Thallium in Various Matrices,
Diflubenzuron Application to Citrus and Its	ENVIRONMENTAL SYSTEMS	W89-03067 5A
Impact on Invertebrates in an Adjacent Pond,	ENGINEERING. Toxicity of Selected RCRA Compounds to Ac-	
W89-03208 5C	tivated Sludge Microorganisms,	COMPAGNIE GENERALE DES EAUX, PARIS
CENTRAL GROUND WATER BOARD, NEW	W89-03165 5D	(FRANCE). New Coagulant Injection Process,
DELHI (INDIA).	COLORADO STATE UNIV., FORT COLLINS.	W89-02798 5F
Groundwater Resources Development and Man-	Experimental Geomorphology (Drainage Net-	
agement in India, W89-02373 2F	work, Piedmont and Channel Morphology),	CONNECTICUT UNIV., STORRS. DEPT. OF
-	W89-02847 2J	CHEMISTRY. Groundwater Protection by Accelerated Testing
CENTRE D'OCEANOLOGIE DE MARSEILLE	COLORADO STATE UNIV., FORT COLLINS.	of Organic Chemical Breakthroughs of Soil Bar-
(FRANCE), Oceanographic Characteristics of the Seine Es-	DEPT. OF AGRICULTURAL AND CHEMICAL	riers,
tuary,	ENGINEERING. Evapotranspiration of Phreatophytes in the San	W89-02585 5A
W89-02699 2L	Luis Valley, Colorado,	CONNECTICUT UNIV., STORRS. INST. OF
CENTRE NATIONAL DE LA RECHERCHE	W89-02478 2D	WATER RESOURCES.
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, TOULOUSE (FRANCE).	Evapotranspiration of Native Vegetation in the	Contribution of Toxic Chemicals to Groundwat-
CENTRE D'ECOLOGIE DES RESSOURCES	Closed Basin of the San Luis Valley, Colorado,	er for Domestic On-Site Sewage Disposal Sys-
RENOUVELABLES.	W89-02481 2D	tems, W89-02584 5B
Role of Riparian Woods in Regulating Nitrogen Fluxes Between the Alluvial Aquifer and Sur-	COLORADO STATE UNIV., FORT COLLINS.	
face Water: A Conceptual Model,	DEPT. OF ATMOSPHERIC SCIENCE.	CONSTRUCTION ENGINEERING RESEARCH
W89-03140 6G	Relationship of Surface Pressure Features to the	LAB. (ARMY), CHAMPAIGN, IL.
CH2M/HILL, DENVER, CO.	Precipitation and Airflow Structure of an In-	Economic Evaluation of Air Stripping to Remove Volatile Organic Compounds from
Unit Process Tradeoffs for Combined Trickling	tense Midlatitude Squall Line, W89-03274 2B	Water,
Filter and Activated Sludge Processes,		W89-02976 5F
W89-03160 5D	COLORADO STATE UNIV., FORT COLLINS.	CONVERSE ENVIRONMENTAL
Enhanced Secondary Treatment Incorporating	DEPT. OF CIVIL ENGINEERING. Influence of Large Suspended-Sediment Con-	
Biological Nutrient Removal,	centrations in Rivers,	In-Situ Hydrocarbon Extraction, A Case Study,
W89-03163 5D	W89-02451 2J	

COOK COLL., NEW BRUNSWICK, NJ. DEPT. OF ENVIRONMENTAL SCIENCE.	DEARBORN CHEMICAL CO. LTD., MISSISSAUGA (ONTARIO),	DUKE UNIV., DURHAM, NC. DEPT. OF CIVIL AND ENVIRONMENTAL
Characteristics of the Sorption of Chlorothalonil	Pilot-Scale Anaerobic Biomass Acclimation	ENGINEERING.
and Azinphos-Methyl to a Soil from a Commer- cial Cranberry Bog,	Studies with a Coal Liquefaction Wastewater, W89-02297 5D	Advisory System for North Carolina Ground- water Quality Modeling and Management
W89-03195 5B	DELAWARE UNIV., LEWES, COLL, OF	Needs, W89-02548 5G
COOPERATIVE INST. FOR RESEARCH IN ENVIRONMENTAL SCIENCE, BOULDER,	MARINE STUDIES. Iodine Speciation in Chesapeake Bay Waters,	W89-02548 5G DURHAM UNIV. (ENGLAND), DEPT. OF
CO. Snow Cover Data: Status and Future Prospects,	W89-03277 2L	GEOGRAPHY.
W89-02618 7B	DELAWARE UNIV., NEWARK. COLL. OF AGRICULTURAL SCIENCES.	Relationship Between Soil Creep Rate and Cer- tain Controlling Variables in a Catchment in
COPENHAGEN UNIV., HILLEROED (DENMARK), DET FERSKVANDS-	Poultry Manure Management and Ground Water Quality: The Delaware Solution,	Upper Weardale, Northern England, W89-02905 2J
BIOLOGISKE LAB. Secondary Production and Trophic Relation-	W89-02678 5G	EASTERN PLATING, INC., NEWPORT, TN.
ships in a Spring Invertebrate Community, W89-03250 2H	DEPARTMENT OF FISHERIES AND OCEANS, VANCOUVER (BRITISH	Pollution Control Using Room Temperature Evaporators,
CORNELL UNIV., ITHACA, NY. DEPT. OF	COLUMBIA). WEST VANCOUVER LAB. Phototrophic Picoplankton: An Overview from	W89-02400 5G
AGRONOMY. Effects of Ozone and Acid Rain on White Pine	Marine and Freshwater Ecosystems, W89-03259 2H	ECOLE NATIONALE SUPERIEURE DES MINES DE PARIS, FONTAINEBLEAU
(Pinus strobus) Seedlings Grown in Five Soils: II. Mycorrhizal Infection,	DEPARTMENT OF FISHERIES AND	(FRANCE), CENTRE D'INFORMATION GEOLOGIQUE,
W89-03057 5C	OCEANS, WINNIPEG (MANITOBA). FRESHWATER INST.	General Review of Methodologies and Ap-
Role of Protozoa in Microbial Acclimation for	Acute Toxicity of Binary Mixtures of Five Ca-	proaches in Mathematical Models for Interpreta-
Mineralization of Organic Chemicals in Sewage, W89-03283 5D	tions $(Cu(2+), Cd(2+), Zn(2+), Mg(2+), and K(+))$ to the Freshwater Amphipod Gammarus	tion of Tracer Data in Hydrology, W89-03011 2F
CORNELL UNIV., ITHACA, NY. DEPT. OF ENVIRONMENTAL ENGINEERING.	lacustris (Sars): Alternative Descriptive Models, W89-03212 5C	ECONOMIC RESEARCH SERVICE, WASHINGTON, DC. NATURAL RESOURCE
Fate of Added Alkalinity During Neutralization of Acid Lake,	Emergence of Chironomidae (Diptera) in Fertil-	ECONOMICS DIV.
W89-03111 5G	ized and Natural Lakes at Saqvaqjuac, N.W.T., W89-03216 2H	Analysis of Agricultural Nonpoint Pollution Control Options in the St. Albans Bay Water-
CORNELL UNIV., ITHACA, NY. SECTION OF ECOLOGY AND SYSTEMATICS.	Accumulation of Cadmium by Rainbow Trout,	shed, W89-02419 5G
Nitrogen Fixation in Freshwater, Estuarine, and Marine Ecosystems: 1. Rates and Importance,	Salmo Gairdneri, During Extended Exposure, W89-03220 5B	ECONOMIC RESEARCH SERVICE,
W89-03254 2H	Nutrient Limitation of Phytoplankton in Fresh-	WASHINGTON, DC. RESOURCES AND TECHNOLOGY DIV.
Nitrogen Fixation in Freshwater, Estuarine, and	water and Marine Environments: A Review of	Managing Farm Nutrients: Tradeoffs for Sur-
Marine Ecosystems: 2. Biogeochemical Con- trols,	Recent Evidence on the Effects of Enrichment, W89-03261 2H	face- and Ground-Water Quality, W89-02833 5G
W89-03255 2H	DEPARTMENT OF GEOLOGY, MINES, AND	
CORVALLIS ENVIRONMENTAL RESEARCH	RURAL WATER SUPPLIES, VILA	EIDGENOESSISCHE ANSTALT FUER WASSERVERSORGUNG,
LAB., OR. Chronic Effects of Contaminated Sediment on	(VANUATU). Hydrogeological Development in Vanuatu, W89-02368 2F	ABWASSERREINIGUNG UND GEWAESSERSCHULTZ, DUEBENDORF
Daphnia magna and Chironomus tentans, W89-03312 5C		(SWITZERLAND),
COUNCIL FOR COTENTIFIC AND	DEPARTMENT OF MINERAL RESOURCES, SUVA (FIJI).	Alternative Treatment of De-Icing Fluids from Airports,
COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, PRETORIA	Hydrogeological Mapping in Fiji,	W89-02807 5D
(SOUTH AFRICA), FOUNDATION FOR RESEARCH DEVELOPMENT.	W89-02366 2F	Factors Controlling the Biogeochemical Cycles
Ecological Research on South African Rivers - A Preliminary Synthesis,	DEPARTMENT OF MINES AND GEOLOGY, KATHMANDU (NEPAL).	of Trace Elements in Fresh and Coastal Marine Waters as Revealed by Artificial Radioisotopes,
W89-02982 2H	Hydrogeology of the Butwal-Bhairahwa Area, Lumbini Zone, Nepal,	W89-03263 2H
Conservation of South African Rivers,	W89-02380 2F	EIDGENOESSISCHE TECHNISCHE
W89-02985 2H	DEPARTMENT OF THE ENVIRONMENT.	HOCHSCHULE, ZURICH (SWITZERLAND).
COVENTRY (LANCHESTER) POLYTECHNIC	LONDON (ENGLAND), WATER	VERSUCHSANSTALT FUER WASSERBAU,
(ENGLAND), DEPT. OF GEOGRAPHY. Some Implications of Small Catchment Solute	ENGINEERING DIRECTORATE. Organic Contaminants in Isolated Lakes of	HYDROLOGIE UND GLAZIOLOGIE. Interaction of Bed Load Transport with Bars.
Studies for Geomorphological Research, W89-02902 2E	Southern Labrador, Canada, W89-03318 5B	W89-02456 2J
	DEUTSCHE GESELLSCHAFT FUER	ELECTRICITE DE FRANCE, PARIS. SERVICE DE LA PRODUCTION HYDRAULIOUE.
DALHOUSIE UNIV., HALIFAX (NOVA SCOTIA). DEPT. OF OCEANOGRAPHY.	WINDENERGIE E.V., HAMBURG	Load-Sharing Linings: A New Design Concept
Temporal Variations in Dissolved and Particu- late Aluminum During a Spring Bloom,	(GERMANY, F.R.). Hydrogeological Problems of Hard Rock Areas	for Large Diameter Penstocks, W89-03158
W89-03192 2L	of Southern India, W89-02374 2F	ELECTRICITY CORP. OF NEW ZEALAND,
DE PAUL UNIV., CHICAGO, IL.	DREVET LIMIT DELL'ADELDITA DA	WELLINGTON.
Design of a Great Lakes Atmospheric Inputs and Sources (GLAIS) Network,	DREXEL UNIV., PHILADELPHIA, PA. ENVIRONMENTAL STUDIES INST.	Upgrading Hydro Turbines: An Operating Authority's Experience,
W89-02418 7A	ganic Contaminants and Taste and Odor,	W89-03152 80
DEAKIN UNIV., MELBOURNE (AUSTRALIA). DIV. OF CHEMICAL AND PHYSICAL	W89-02793 5F	ELECTRONIC TECHNIQUES, INC., FORT
SCIENCES	DU PONT DE NEMOURS (E.I.) AND CO.,	COLLINS, CO. Diagnostic Technique for Targeting during Air
Effects of Temperature, Salinity and Seagrass Species on the Uptake of Lead(II) from Sea-	Waste Water Reduction in Metal Fabrications	borne Seeding Experiments in Wintertim
water by Excised Leaves, W89-03275 5B	Operations, W89-02405 5D	Storms over the Sierra Nevada, W89-03305 21

ELECTROWATT ENGINEERING SERVICES LTD., ZURICH (SWITZERLAND).

ELECTROWATT ENGINEERING SERVICES LTD., ZURICH (SWITZERLAND). Uprating the Laufenburg Swiss/German Power	Composting of Municipal Wastewater Sludges. W89-02855 5D	ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. OFFICE OF ACID DEPOSITION, ENVIRONMENTAL
Station with Ten Straflo Units, W89-03071 8C	Municipal Wastewater Sludge Combustion Technology.	MONITORING, AND QUALITY ASSURANCE.
	W89-02872 5D	Western Lake Survey, Phase I. Data Base. W89-02946 2H
EMCON ASSOCIATES, SAN JOSE, CA. Applying Electrical Resistance Blocks for Un-	ENVIRONMENTAL PROTECTION AGENCY,	1107-027-10
saturated Zone Monitoring at Arid Sites, W89-02352 7B	CINCINNATI, OH. HAZARDOUS WASTE ENGINEERING RESEARCH LAB. Treatment of Aqueous Metal Bearing Hazardous	ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. OFFICE OF DRINKING WATER.
ENERGETICS, INC., COLUMBIA, MD. Analysis of Biomonitoring Techniques to Sup-	Wastes, W89-02396 5D	National Survey of Pesticides in Drinking Water Wells,
plement Effluent Guidelines. W89-02994 5A	Stringfellow Leachate Treatment with RBC,	W89-02656 5B
	W89-03328 5D	ENVIRONMENTAL PROTECTION AGENCY,
ENGINEERING ENTERPRISES, INC., LONG BEACH, CA.	ENVIRONMENTAL PROTECTION AGENCY,	WASHINGTON, DC. OFFICE OF
Impact of the Newport-Inglewood Structural	CINCINNATI, OH. OFFICE OF RESEARCH AND DEVELOPMENT.	EMERGENCY AND REMEDIAL RESPONSE. Superfund Record of Decision: Rockaway Bor-
Zone on Hydrogeologic Mitigation Efforts: Los Angeles Basin, California,	Health and Environmental Effects Profile for	ough Well Field, NJ.
W89-02342 2F	1,2,3,4,5-Penta-Bromo-6-Chlorocyclohexane. W89-02866 5C	W89-02706 5D
Advantages of Suction Lift Hydrocarbon Re-	ENVIRONMENTAL PROTECTION AGENCY,	Superfund Record of Decision: Combe Fill
covery Systems: Application At Three Hydro-	CINCINNATI, OH. WATER ENGINEERING	North Landfill, NJ.
geologic Environments in California, W89-02358 5G	RESEARCH LAB.	W89-02707 5G
	Partitioning of Toxic Organic Compounds on Municipal Wastewater Treatment Plant Solids,	Superfund Record of Decision: Distler Farm
ENGINEERING-SCIENCE, FAIRFAX, VA. Patapsco Wastewater Treatment Plant Toxicity	W89-02299 5D	KY.
Reduction Evaluation,	Fate of Water Soluble Azo Dyes in the Activat-	W89-02778 5G
W89-02300 5D	ed Sludge Process, W89-02935 5D	Superfund Record of Decision: Northern En-
ENVIRONMENTAL HEALTH	W89-02935 5D	graving, WI.
DIRECTORATE, OTTAWA (ONTARIO). ENVIRONMENTAL AND OCCUPATIONAL	Pilot-Plant Evaluations of Porous Biomass Sup-	W89-02938 5E
TOXICOLOGY DIV.	ports, W89-03104 5D	Superfund Record of Decision: Kane and Lom-
Results of a Short-Term Toxicity Study for Three Organic Chemicals Found in Niagara	Municipal Wastewater Treatment Technology	bard, MD.
River Drinking Water,	Transfer Activities of the United States Environ-	W89-02977 5E
W89-03310 5C	mental Protection Agency, W89-03325 5D	Superfund Record of Decision: Katonah Munici
ENVIRONMENTAL MONITORING SYSTEMS	W89-03325 5D	pal Well, NY.
LAB., RESEARCH TRIANGLE PARK, NC. Acid Precipitation in North America: 1985 Annual and Seasonal Data Summaries from	Biological Wastewater Treatment of Azo Dyes, W89-03327 5D	W89-02979 5C
Acid Deposition System Data Base,	ENVIRONMENTAL PROTECTION AGENCY,	Superfund Record of Decision: Independen Nail, SC.
W89-02997 5B	GULF BREEZE, FL. GULF BREEZE ENVIRONMENTAL RESEARCH LAB.	W89-02980 50
ENVIRONMENTAL PROTECTION AGENCY,	Acute Toxicity of Malathion, Tetrabromobis-	
ANNAPOLIS, MD. CHESAPEAKE BAY PROGRAM.	phenol-A, and Tributyltin Chloride to Mysids (Mysidopsis bahia) of Three Ages,	Superfund Record of Decision: Endicott Well Field, NY.
Multidecade Trend-Monitoring Program for	W89-03203 5C	W89-02983 50
Chesapeake Bay, A Temperate East Coast Estu-	ENVIRONMENTAL PROTECTION AGENCY,	
ary, W89-02324 7A	NARRAGANSETT, RI. ENVIRONMENTAL RESEARCH LAB.	Superfund Record of Decision: Vega Alta, PR W89-02984 50
ENVIRONMENTAL PROTECTION AGENCY, CHICAGO, IL. GREAT LAKES NATIONAL	Coastal Monitoring: Evaluation of Monitoring Methods in Narragansett Bay, Long Island	ENVIRONMENTAL PROTECTION AGENCY,
PROGRAM OFFICE.	Sound and New York Bight, and a General	WASHINGTON, DC. OFFICE OF HEALTH
Final Report: Lake Erie Conservation Tillage Demonstration Projects.	Monitoring Strategy, W89-02325 5A	AND ENVIRONMENTAL ASSESSMENT. Health and Environmental Effects Profile for
W89-02835 3F	ENVIRONMENTAL PROTECTION AGENCY.	Phenylenediamines.
Lake Erie Conservation Tillage Demonstration	NEW YORK. REGION II.	W89-02868 56
Projects: Evaluating Management of Pesticides,	Assessment of Empirical Methodologies for Pre- dicting Ground Water Pollution from Agricul-	ENVIRONMENTAL PROTECTION AGENCY,
Fertilizer, Residue to Improve Water Quality. W89-02837 3F	tural Chemicals, W89-02670 5B	WASHINGTON, DC. OFFICE OF THE ASSISTANT ADMINISTRATOR FOR WATER
ENVIRONMENTAL PROTECTION AGENCY,	ENVIRONMENTAL PROTECTION AGENCY,	Value Engineering for Small Communities.
CINCINNATI, OH. Hazardous Waste Research Pertaining to Metal	WASHINGTON, DC. INDUSTRIAL	W89-02865 6
Finishing,	TECHNOLOGY DIV. Supplemental Final Development Document for	ENVIRONMENTAL PROTECTION AGENCY,
W89-02393 5G	Effluent Limitations Guidelines, New Source Performance Standards and Pretreatment Stand-	WASHINGTON, DC. OFFICE OF TOXIC SUBSTANCES.
Promising Technologies for the Biological De- toxification of Hazardous Waste,	ards for the Leather Tanning and Finishing	Monitoring the Nation's WatersA New Pe
W89-03322 5D	Point Source Category. W89-02832 6E	spective, W89-02318
ENVIRONMENTAL PROTECTION AGENCY.	ENVIRONMENTAL PROTECTION AGENCY,	
CINCINNATI, OH. CENTER FOR	WASHINGTON, DC. MUNICIPAL	ENVIRONMENTAL PROTECTION SERVICE BURLINGTON (ONTARIO), WASTE WATER
ENVIRONMENTAL RESEARCH INFORMATION.	FACILITIES DIV. It's Your Choice: A Guidebook for Local Offi-	TECHNOLOGY CENTRE.
Use and Disposal of Municipal Wastewater	cials on Small Community Wastewater Manage-	Fate of 4,6-Dinitro-o-Cresol in Municipal Ac
Sludge. W89-02834 5E	ment Options. W89-02838 5D	vated Sludge Systems, W89-02296
	35	07-06670

5D

GEOLOGICAL SURVEY, AUSTIN, TX. WATER RESOURCES DIV.

ENVIRONMENTAL RESEARCH LAB., DULUTH, MN.	Zooplankton Biomass Exchange in Lake Sharpe, South Dakota, 1974-1975,	GEOLOGICAL SURVEY, ALBUQUERQUE, NM. WATER RESOURCES DIV.
Ambient Water Quality Criteria for Chloride - 1988,	W89-02425 2H	Hydrology of Area 62, Northern Great Plains and Rocky Mountain Coal Provinces-New
W89-02860 5G Acute Toxicity and Behavioral Effects of Acry-	Relative Abundance and Distribution of Young- of-the-Year Fishes and Minnows in Lake	Mexico and Arizona, W89-02498 2F
lates and Methacrylates to Juvenile Fathead	Sharpe, South Dakota, W89-02426 2H	Description of Piezometer Nests and Water
Minnows, W89-03313 5C	Biology of the Walleye in Lake Sharpe, South	Levels in the Rio Grande Valley Near Albu- querque, Bernalillo County, New Mexico,
ENVIRONMENTAL STRATEGIES CORP., SAN JOSE, CA.	Dakota, 1964-1975, W89-02427 2H	W89-02509 2F
Membrane Separation Technologies for Treat-		Hydrogeology of the Socorro and La Jencia
ment of Hazardous Wastes, W89-03284 5D	Biology of the Yellow Perch in Lake Sharpe, South Dakota, 1964-1975,	Basins, Socorro County, New Mexico, W89-02517 2F
ESSO PETROLEUM CANADA, SARNIA	W89-02428 2H	6
(ONTARIO). RESEARCH DEPT.	Early Life History and Winter Mortality of Giz-	Seasonal Changes in Groundwater Levels in the Shallow Aquifers Near Hagerman and the Pecos
Bacterial Leaching of Heavy Metals from An- aerobically Digested Sludge,	zard Shad in Lake Sharpe, South Dakota, W89-02429 2H	River, Chaves County, New Mexico,
W89-02925 5D	W 89-02429 2H	W89-02601 4B
EUSTANCE AND HOROWITZ, CIRCLEVILLE, NY.	FISH AND WILDLIFE SERVICE, WASHINGTON, DC.	GEOLOGICAL SURVEY, ALEXANDRIA, LA. WATER RESOURCES DIV.
Flotation Processes,	Limnological and Fishery Studies on Lake	Water Level Measurements 1981-85 and Chemi-
W89-02975 5D	Sharpe, a Main-stem Missouri River Reservoir, 1964-1975,	cal Analyses 1978-85, Red River Alluvial Aqui-
EVANS-HAMILTON, INC., SEATTLE, WA.	W89-02423 2H	fer, Red River Valley, Louisiana, W89-02582 7C
Puget Sound: A Fjord System Homogenized with Water Recycled over Sills by Tidal Mixing,	PLODENCE INIU (TALV) DEBT OF COM	
W89-02694 2L	FLORENCE UNIV. (ITALY). DEPT. OF CIVIL ENGINEERING.	GEOLOGICAL SURVEY, ANCHORAGE, AK. WATER RESOURCES DIV.
EXETER UNIV. (ENGLAND), DEPT. OF	Bed Load Transport Measurements by the Vortex-tube Trap on Virginio Creek, Italy,	Sediment Discharge Data for the Lower Reach
GEOGRAPHY. Suspended Load in Gravel-Bed Rivers: UK Ex-	W89-02449 7B	of Campbell Creek, Anchorage, Alaska: May to September 1987,
perience, W89-02452 2J	FLORIDA UNIV., GAINESVILLE, DEPT. OF	W89-02496 2J
	ENVIRONMENTAL ENGINEERING SCIENCES.	Map Showing Groundwater Levels in Anchor-
Erosion and Sedimentation, W89-02723 2J	Effect of Temperature on the Chronic Toxicity	age, Alaska, 1985, W89-02526 7C
Catchment Experiments in Fluvial Geomorphology: A Review of Objectives and Methodolo-	of Hydrothol-191 to the Fathead Minnow (Pi- mephales promelas), W89-03206 5C	Hydrologic Reconnaissance of the Chilkat River
gy. W89-02881 2E		Basin, Southeast Alaska (with Special Reference to the Bald Eagle Critical Habitat at the Tsirku
	FLORIDA UNIV., GAINESVILLE, DEPT. OF FISHERIES AND AQUACULTURE.	River Alluvial Fan),
Suspended Sediment Properties and Their Geo- morphological Significance,	Influence of Nutrient Enrichment and Light	W89-02565 2E
W89-02899 2J	Availability on the Abundance of Aquatic Ma-	GEOLOGICAL SURVEY, ARVADA, CO.
Manitude and Francisco Chambridge of	crophytes in Florida Streams, W89-03231 5C	Reconnaissance of the Hydrothermal Resources
Magnitude and Frequency Characteristics of Suspended Sediment Transport in Devon		of Utah, W89-03020 2F
Rivers, W89-02904 2J	FRESHWATER BIOLOGICAL ASSOCIATION, AMBLESIDE (ENGLAND).	***************************************
W89-02904 2J	Time-Varying Stochastic Model of the Frequen-	Effects of Future Ground-Water Pumpage on
FEDERAL UNIV. OF TECHNOLOGY,	cy and Magnitude of Bed Load Transport	the High Plains Aquifer in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma,
OWERRI (NIGERIA), SCHOOL OF NATURAL AND APPLIED SCIENCES.	Events in Two Small Trout Streams, W89-02459 2J	South Dakota, Texas, and Wyoming,
Groundwater Occurrence and Flow Pattern in		W89-03031 2F
the Enugu Coal-Mine Area, Anambra State, Ni- geria,	FUJI ELECTRIC CO. LTD., KAWASAKI	Regional Aquifer System Underlying the North-
W89-03051 2F	(JAPAN). HYDRO POWER DIV. Calculation of Prototype Cavitation Characteris-	ern Great Plains in Parts of Montana, North
FIELD STUDIES COUNCIL, PEMBROKE	tics in Large Bulb Turbines,	Dakota, South Dakota, and Wyoming: Summa-
(WALES), OIL POLLUTION RESEARCH	W89-03070 8C	ry, W89-03033 2F
UNIT. Subtidal Rock and Shallow Sediments Using	GCA CORP., BEDFORD, MA. GCA	Runoff Characteristics and Washoff Loads from
Diving,	TECHNOLOGY DIV. Corrective Measures for Releases to Ground-	Rainfall-Simulation Experiments on a Street Sur-
W89-02768 7B	water from Solid Waste Management Units,	face and a Native Pasture in the Denver Metro-
FIELD STUDIES COUNCIL, SHREWSBURY (ENGLAND).	W89-02844 5G	politan Area, Colorado, W89-03036 2E
Planning Biological Surveys,	GENEVA UNIV. (SWITZERLAND), DEPT. OF	GEOLOGICAL SURVEY, AUSTIN, TX.
W89-02760 7B	INORGANIC, ANALYTICAL AND APPLIED CHEMISTRY.	WATER RESOURCES DIV.
Intertidal Rock, W89-02767 2L	Combining Field Measurements for Speciation	Groundwater Resources of Rusk County, Texas, W89-02491 2F
	in Non Perturbable Water Samples: Application to the Iron and Sulfide Cycles in a Eutrophic	11 07-02-17 1 2F
FINISH ENGINEERING CO., ERIE, PA. Successful In House Recovery of Solvent,	Lake,	Hydrologic and Geologic Data for the Edwards
W89-02410 5G	W89-02645 5B	Aquifer Recharge Zone Near Georgetown, Wil- liamson County, Texas, 1986-87,
FISH AND WILDLIFE SERVICE, PIERRE,	GEOLOGIAN TUTKIMUSKESKUS, ESPOO	W89-02499 2F
SD. NORTH CENTRAL RESERVOIR INVESTIGATIONS.	(FINLAND). DEPT. OF GEOCHEMISTRY. Atmospheric, Geological, Marine, and Anthro-	Relation of Water Chemistry of the Edwards
Physical, Chemical, and Biological Characteris-	pogenic Effects on Groundwater Quality in Fin-	Aquifer to Hydrogeology and Land Use, San
tics of Lake Sharpe, South Dakota, 1966-1975, W89-02424	land, W89-03076 5B	Antonio Region, Texas, W89-02514 5B

GEOLOGICAL SURVEY, AUSTIN, TX. WATER RESOURCES DIV.

Effects of Runoff Controls on the Quantity and Quality of Urban Runoff at Two Locations in Austin, Texas,	Data on Groundwater Quality for the Reno One Degree X Two Degree Quadrangle, Western Nevada,	Comparison of Conceptually Based and Regression Rainfall-Runoff Models, Denver Metropolitan Area, Colorado, and Potential Applications
W89-02518 5B	W89-02540 7C	in Urban Areas,
		W89-02483 4C
Water Resources Activities of the U. S. Geologi-	Data on Groundwater Quality for the Tonopah	
cal Survey in Texas - Fiscal Year 1987, W89-02574 9C	One Degree X Two Degree Quadrangle, Central Nevada, W89-02542 7C	Methods for Hydrologic Monitoring of Surface Mining in the Central-Western United States,
Water Quality of Canyon Lake, Central Texas,		W89-02490 7A
W89-02579 2H	Data on Groundwater Quality for the Western	Techniques for Estimating Regional Flood
Groundwater Resources of Limestone County,	Nevada Part of the Goldfield One Degree X Two Degree Quadrangle,	Characteristics of Small Rural Watersheds in the
Texas,	W89-02543 7C	Plains Region of Eastern Colorado,
W89-02583 2F		W89-02507 2E
Hydrologic Data for Urban Studies in the	Data on Groundwater Quality for the Caliente One Degree X Two Degree Quadrangle, East-	Water Quality Assessment of Arvada Reservoir,
Austin Metropolitan Area, Texas, 1986,	ern Nevada,	Denver Metropolitan Area, Colorado,
W89-02597 4C	W89-02544 7C	W89-02562 . 2H
GEOLOGICAL SURVEY, BATON ROUGE, LA.	Data on Groundwater Quality for the Western	U.S. Geological Survey Urban-Stormwater Data
VATER RESOURCES DIV.	Nevada Part of the Death Valley One Degree X	Base of Constituent Storm Loads; Characteris-
Pumpage of Water in Louisiana, 1985,	Two Degree Quadrangle,	tics of Rainfall, Runoff, and Antecedent Condi-
W89-02506 6D	W89-02545 7C	tions; and Basin Characteristics,
GEOLOGICAL SURVEY, BOISE, ID. WATER	Data on Groundwater Quality for the Southern	W89-02581 7C
RESOURCES DIV.	Nevada Part of the Kingman One Degree X	Hydrologic Analysis of the Rio Grande Basin
Water Quality Data for the Boise River, Boise to	Two Degree Quadrangle,	North of Embudo, New Mexico, Colorado and
Star, Idaho, October to December 1987, W89-02464 5C	W89-02546 7C	New Mexico,
	Geophysical Logs and Hydrological Data for	W89-02589 2F
Selected Water-Quality Data for the Murtaugh	Eight Wells in the Coyote Spring Valley Area,	Relations of Specific Conductance to Stream-
Lake Area, South Central Idaho, June 1987, W89-02530 7C	Clark and Lincoln Counties, Nevada, W89-02603 4B	flow and Selected Water Quality Characteristics
	407-02003	of the Arkansas River Basin, Colorado,
Quality of Ground Water in the Payette River	GEOLOGICAL SURVEY, CHARLESTON, WV.	W89-02599 2K
Basin, Idaho, W89-03008 5G	WATER RESOURCES DIV. Hydrology of Area 8, Eastern Coal Province,	Computer-Program Documentation of an Inter-
	West Virginia and Ohio,	active-Accounting Model to Simulate Stream-
GEOLOGICAL SURVEY, CARSON CITY, NV.	W89-02598 4C	flow, Water Quality, and Water-Supply Oper-
WATER RESOURCES DIV. Method for Delineating Flood-Prone Areas in	GEOLOGICAL SURVEY, CHEYENNE, WY.	ations in a River Basin, W89-02600 7C
the Great Basin of Nevada and Adjacent States,	WATER RESOURCES DIV.	W 67-02000
W89-02500 2E	Groundwater Levels in Wyoming, 1978	Sediment-Data Sources and Estimated Annual
Documentation for a Digital Computer Model	Through September 1987,	Suspended-Sediment Loads of Rivers and
of Nutrient and Dissolved-Oxygen Transport in	W89-02468 4B	Streams in Colorado, W89-02604 2J
the Truckee River and Truckee Canal Down-	Evapotranspiration Rates at Selected Sites in the	W 69-02004
stream from Reno, Nevada, W89-02504 5B	Powder River Basin, Wyoming and Montana,	GEOLOGICAL SURVEY, DORAVILLE, GA.
W 67-02304	W89-02524 2D	WATER RESOURCES DIV.
Data on Groundwater Quality for the Millett 1	Groundwater Levels in Wyoming, 1976	Simulation of Flood Hydrographs for Georgia Streams,
Degree X 2 Degree Quadrangle, Central Nevada,	Through 1985,	W89-03002 5E
W89-02533 7C	W89-02525 7C	
	Hydrology of the White Tail Butte Area, North-	GEOLOGICAL SURVEY, HARRISBURG, PA.
Data on Groundwater Quality for the Elko 1	ern Campbell County, Wyoming,	WATER RESOURCES DIV. Statistical Analyses of Flood Frequency, Low-
Degree X 2 Degree Quadrangle, Eastern Nevada,	W89-02596 4C	Flow Frequency and Flow Duration of Streams
W89-02534 7C	GEOLOGICAL SURVEY, DE KALB, IL.	in the Philadelphia Area, Pennsylvania,
Data on Groundwater Quality for the Ely 1	WATER RESOURCES DIV.	W89-02492 2E
Degree X 2 Degree Quadrangle, Eastern	Discharge Ratings for Control Structures at McHenry Dam on the Fox River, Illinois,	GEOLOGICAL SURVEY, HELENA, MT.
Nevada,	W89-02494 7B	WATER RESOURCES DIV.
W89-02535 7C	CECLOGICAL CURVEY PERSONS	Supplemental Arsenic Data for Selected Streams
Data on Groundwater Quality for the Lund 1	GEOLOGICAL SURVEY, DENVER, CO. Formation of a Coarse Surface Layer as the	in the Missouri River Basin, Montana, 1987,
Degree X 2 Degree Quadrangle, Eastern	Response to Gravel Mobility,	W89-02516 5B
Nevada,	W89-02440 2J	Data on Groundwater Quality for the Walker
W89-02536 7C	Elected Hydrologic Data for Pahvant Valley	Lake One Degree X Two Degree Quadrangle,
Data on Groundwater Quality for the McDer-	and Adjacent Areas, Millard County, Utah,	Western Nevada and Eastern California,
mitt One Degree X Two Degree Quadrangle,	1987,	W89-02541 7C
Northern Nevada, W89-02537 7C	W89-02569 7C	Water Quality Data (July 1986 Through Sep-
	Emerging Issues in Surface Water Quality Re-	tember 1987) and Statistical Summaries (March
Data on Groundwater Quality for the Lovelock	search,	1985 Through September 1987) for the Clark Fork and Selected Tributaries from Deer Lodge
One Degree X Two Degree Quadrangle, West- ern Nevada.	W89-02721 5G	to Missoula, Montana,
W89-02538 7C	GEOLOGICAL SURVEY, DENVER, CO.	W89-02566 5B
	WATER RESOURCES DIV.	Desire of Paris, Date to Co.
Data on Groundwater Quality for the Winne- mucca One Degree X Two Degree Quadrangle,	External Quality-Assurance Results for the Na- tional Atmospheric Deposition Program and Na-	Results of Experiments Related to Contact of Mine-Spoils Water with Coal, West Decker and
Central Nevada,	tional Trends Network During 1986,	Big Sky Mines, Southeastern Montana,
W89-02539 7C	W89-02463 7C	W89-03001 5B

GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV.

GEOLOGICAL SURVEY, HONOLULU, HI. WATER RESOURCES DIV.	Methods for Collection and Analysis of Aquatic Biological and Microbiological Samples,	Construction, Geologic, and Hydrologic Data for Observation Wells in the Reelfoot Lake
Selected Hydrogeologic Data for the Southwest Glendive Preliminary Logical Mining Unit and	W89-02568 7B	Area, Tennessee and Kentucky, W89-02510 7B
Adjacent Areas, Dawson County, Montana,	Calibration of a Dissolved-Solids Model for the	W89-02510 7B
W89-02531 7C	Yampa River Basin Between Steamboat Springs and Maybell, Northwestern Colorado,	Water Quality of Runoff to the Clarksville Me-
GEOLOGICAL SURVEY, HOUSTON, TX. WATER RESOURCES DIV.	W89-02591 5B	morial Hospital Drainage Well and of Mobley Spring, Clarksville, Tennessee, February-March
Records of Wells, Drillers' Logs, Water Level	Surface Water Quality Characteristics in the	1988, W89-02556 5B
Measurements, and Chemical Analyses of Groundwater in Harris and Galveston Counties,	Upper North Fork Gunnison River Basin, Colo-	75
Texas 1980-84,	rado, W89-02593 5B	Quality of Groundwater in Shallow Wells in
W89-02497 7C	CROLOGICAL CURVEY LANGING MI	Agricultural Areas of Haywood, Shelby, Lake, and Obion Counties, Tennessee, January-Febru-
Development of Groundwater Resources in the	GEOLOGICAL SURVEY, LANSING, MI. WATER RESOURCES DIV.	ary 1988,
Orange County Area, Texas and Louisiana, 1980-Spring of 1985,	Groundwater Data for Michigan-1986,	W89-02557 5B
W89-02513 2F	W89-02495 7C	Water Resources Investigations in Tennessee:
Groundwater Withdrawals and Changes in	GEOLOGICAL SURVEY, LAWRENCE, KS.	Programs and Activities of the U.S. Geological Survey, 1987-1988,
Groundwater Quality and Land Surface Subsid- ence in the Houston District, Texas,	WATER RESOURCES DIV. Hydrology of Area 40, Western Region, Interior	W89-02559 7C
W89-02519 6G	Coal Province, Kansas, Oklahoma and Missouri, W89-02488	Water Resources Investigations in Tennessee:
GEOLOGICAL SURVEY, HURON, SD.	W89-02488 4C	Programs and Activities of the U.S. Geological
WATER RESOURCES DIV.	January 1987 Water Levels, and Data Related to	Survey, 1987-1988,
Water Resources of Walworth County, South Dakota,	Water Level Changes, Western and South-Cen- tral Kansas,	W89-02570 9C
W89-02489 2F	W89-02594 2F	Regionalization of Winter Low-flow Character-
Records of Wells and Chemical Analyses of	GEOLOGICAL SURVEY, LITTLE ROCK, AR.	istics of Tennessee Streams, W89-03005 2E
Groundwater in Hand and Hyde Counties South	WATER RESOURCES DIV.	110703003
Dakota, W89-02505 2F	Groundwater Levels in the Alluvial Aquifer in Eastern Arkansas, 1986,	GEOLOGICAL SURVEY OF MALAYSIA,
	W89-02522 2F	IPOH. HYDROGEOLOGY DIV. Status of Hydrogeological Mapping in Peninsu-
Drainage Areas in the James River Basin in Eastern South Dakota,	Effects of Fluctuating River-Pool Stages on	lar Malaysia,
W89-02515 7C	Groundwater Levels in the Adjacent Alluvial	W89-02377 2F
GEOLOGICAL SURVEY, IOWA CITY, IA.	Aquifer in the Lower Arkansas River, Arkansas, W89-02561 2F	GEOLOGICAL SURVEY OF MALAYSIA,
Impacts of Agricultural Chemicals on Ground	W 69-02301 2F	KUCHING, HYDROGEOLOGY SECTION.
Water Quality in Iowa, W89-02668 5B	Generalized Potentiometric Surface of the Sparta-Memphis Aquifer, Eastern Arkansas,	Notes on the Hydrogeological Map of Sarawak, W89-02378 2F
GEOLOGICAL SURVEY, LAKEWOOD, CO.	Spring 1980, W89-02575 7C	GEOLOGICAL SURVEY OF WESTERN
Bed Load Sampling and Analysis, W89-02434 2J		AUSTRALIA, PERTH. DEPT. OF MINES. Organization of Hydrogeological Mapping Pro-
Hudrology Geomorphology and Dom Beach	Annual Yield and Selected Hydrologic Data for the Arkansas River Basin Compact, Arkansas-	grams,
Hydrology, Geomorphology, and Dam-Break Modeling of the July 15, 1982, Lawn Lake Dam	Oklahoma, 1987 Water Year,	W89-02388 7B
and Cascade Lake Dam Failures, Larimer County, Colorado,	W89-02602 2E	GEOLOGICAL SURVEY, ORLANDO, FL.
W89-03027 8A	GEOLOGICAL SURVEY, MADISON, WI.	WATER RESOURCES DIV.
Magnitude and Frequency of Debris Flows, and	WATER RESOURCES DIV. History of Annual Streamflows from the 21	Potentiometric Surface of the Upper Floridan Aquifer in the St. Johns River Water Manage
Areas of Hazard on Mount Shasta, Northern	Water Resources Regions in the United States	ment District and Vicinity, Florida, September
California, W89-03029 2J	and Puerto Rico, 1951-83, W89-02493 7C	1987, W89-02503 7C
Hydrology and Chemistry of Selected Prairie Wetlands in the Cottonwood Lake Area, Stuts-	Estimating Magnitude and Frequency of Floods for Wisconsin Urban Streams.	GEOLOGICAL SURVEY, PASCO, WA. Geology of the Fresh Ground-Water Basin of
man County, North Dakota, 1979-82,	W89-03003 2E	the Central Valley, California, with Texture
W89-03035 2H	GEOLOGICAL SURVEY, MENLO PARK, CA.	Maps and Sections, W89-03032
GEOLOGICAL SURVEY, LAKEWOOD, CO. WATER RESOURCES DIV.	WATER RESOURCES DIV.	W 89-03032
Results of Intercomparison Studies for the Meas-	Eulerian and Lagrangian Modeling of Estuarine Hydrodynamics,	GEOLOGICAL SURVEY, RESTON, VA.
urements of pH and Specific Conductance at National Atmospheric Deposition Program/Na-	W89-02691 2L	WATER RESOURCES DIV. Roughness Coefficients for Densely Vegetater
tional Trends Network Monitoring Sites, Octo-	GEOLOGICAL SURVEY, MONTGOMERY,	Flood Plains,
ber 1981-October 1985, W89-02485 5A	AL. WATER RESOURCES DIV.	W89-02502 28
	Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama;	Data on the Distribution and Abundance of Sub
Effects of Organic Wastes from Processing of Green River Formation Oil Shale on Water	Area 8,	mersed Aquatic Vegetation in the Tidal Poto mac River and Estuary, Maryland, Virginia, and
Quality,	W89-02564 5B	the District of Columbia, 1986,
W89-02487 5B	Geohydrology and Susceptibility of Coldwater	W89-02511 76
Hydrology of Area 59, Northern Great Plains	Spring and Jacksonville Fault Areas to Surface Contamination in Calhoun County, Alabama,	Flow Simulation Model of the Tidal Potoma
and Rocky Mountain Coal Provinces, Colorado and Wyoming,	W89-02576 5B	River,
W89-02501 2E	CEOLOGICAL SUBVEY NASHVILLE TN	W89-02529 21
Groundwater Flow in the Navajo Sandstone in	GEOLOGICAL SURVEY, NASHVILLE, TN. WATER RESOURCES DIV.	Concept of Electron Activity and its Relation t
Parts of Emery, Grand, Carbon, Wayne, Gar-	Water Resources Publications of the U.S. Geo-	Redox Potentials in Aqueous Geochemical Systems,
field, and Kane Counties, Southeast Utah, W89-02521 2F	logical Survey, For Tennessee, 1906-1987, W89-02467 10C	W89-02580 21

GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV.

Analytically-Derived Sensitivities in One-Di- mensional Models of Solute Transport in Porous Media.	GEOLOGICAL SURVEY, TALLAHASSEE, FL. Assimilative Capabilities of Retention Ponds, W89-02856 5D	Data-Collection Methods and Data Summary for the Assessment of Water Quality in Cedar Creek, West-Central Illinois,
Media, W89-02595 5B		W89-02520 7B
	GEOLOGICAL SURVEY, TALLAHASSEE, FL.	
Natural Flow and Water Consumption in the	WATER RESOURCES DIV. Summary of Well Construction, Testing, and	Estimating Generalized Skew of the Log-Pear-
Milk River Basin, Montana and Alberta, Canada, W89-03004	Preliminary Findings from the Alligator Alley	son Type III Distribution for Annual Peak Floods in Illinois,
110703007	Test Well, Broward County, Florida,	W89-03006 2E
Configuration and Hydrology of the Pre-Creta-	W89-02465 4B	
ceous Rocks Underlying the Southeastern Coast- al Plain Aquifer System,	Bibliography of U.S. Geological Survey Reports	GEOLOGICAL SURVEY, VANCOUVER, WA.
W89-03007 2F	on the Water Resources of Florida, 1886-1984, W89-02527 10C	WATER RESOURCES DIV. Vertical Profiles of Velocity and Suspended Sediment in Streams near Mount St. Helens,
GEOLOGICAL SURVEY, ROLLA, MO.	GEOLOGICAL SURVEY, TAMPA, FL. WATER	Washington,
Groundwater Flow System in Northern Missou- ri with Emphasis on the Cambrian-Ordovician	RESOURCES DIV.	W89-02523 2J
Aquifer,	Potentiometric Surface of the Intermediate Aq-	
W89-03023 2F	uifer System, West-Central Florida, September 1986.	Hydrologic Data for Computation of Sediment Discharge, Toutle and North Fork Toutle
GEOLOGICAL SURVEY, ROLLA, MO.	W89-02532 7C	Rivers near Mount St. Helens, Washington,
WATER RESOURCES DIV.	CEGLOCICAL SUBVEY TRENTON NI	1980-84.
Water Resources Activities of the U.S. Geologi-	GEOLOGICAL SURVEY, TRENTON, NJ. WATER RESOURCES DIV.	W89-02571 7C
cal Survey in Missouri, Fiscal Year 1987, W89-02470 9C	Selected Literature on Water Resources Investi-	GEOMORPHOLOGICAL SERVICES LTD.,
W89-02470 9C	gations in New Jersey by the U.S. Geological	MARLOW (ENGLAND).
Hydrology and Water Quality at the Weldon	Survey, Through 1986, W89-02466 10C	Pattern of Wash Erosion Around an Upland
Spring Radioactive Waste-Disposal Sites, St.	100	Stream Head,
Charles County, Missouri, W89-02528 5B	Rainfall-Runoff Data for Somerset County, New	W89-02886 2J
W 69-02326	Jersey, W89-02592 2E	GEORGIA INST. OF TECH., ATLANTA.
Water Resources Activities of the U.S. Geologi-	11 03-02372	SCHOOL OF CIVIL ENGINEERING.
cal Survey in Missouri, Fiscal Year 1987.	GEOLOGICAL SURVEY, TUCSON, AZ.	Ocean Outfall System for Dense and Buoyant
W89-02567 9C	WATER RESOURCES DIV. Determination of Evaporation and Seepage	Effluents,
GEOLOGICAL SURVEY, SALT LAKE CITY, UT.	Losses, Upper Lake Mary near Flagstaff, Arizo- na,	W89-03108 5E
Seepage Study of A 15.3 Mile Section of the	W89-02558 2H	GEORGIA INST. OF TECH., ATLANTA. SCHOOL OF GEOPHYSICAL SCIENCES.
Central Utah Canal, Pahvant Valley, Millard County, Utah,	Aggradation and Degradation of Alluvial Sand	Measurements of Binding Site Concentrations in
W89-02469 2E	Deposits, 1965 to 1986, Colorado River, Grand	Humic Substances,
	Canyon National Park, Arizona,	W89-02647 7B
GEOLOGICAL SURVEY, ST. PAUL, MN.	W89-02973 2J	GEORGIA INST. OF TECH., ATLANTA.
WATER RESOURCES DIV. Water Quality Data for Orwell Reservoir and	GEOLOGICAL SURVEY, TUSCALOOSA, AL.	WATER RESOURCES CENTER.
the Otter Tail River Near Fergus Falls, Minne-	WATER RESOURCES DIV.	Fiscal Year 1987 Report (Georgia Water Re-
sota,	Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama;	sources Research Institute), W89-02553 9D
W89-02605 5B	Area 9,	W89-02555 9D
GEOLOGICAL SURVEY, ST. SIMONS ISLAND, GA.	W89-02563 5B	GEORGIA UNIV., ATHENS, INST. OF ECOLOGY.
Summary of the Hydrology of the Floridan Aq-	Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama,	High-Precision Respirometer for Measuring
uifer System in Florida and in Parts of Georgia, South Carolina, and Alabama,	Area 7.	Small Rates of Change in the Oxygen Concen- tration of Natural Waters,
W89-03034 2F	W89-02577 5B	W89-03252 7B
	Geohydrology and Susceptibility of Major	
GEOLOGICAL SURVEY, TACOMA, WA.	Aquifers to Surface Contamination in Alabama,	GESAMTHOCHSCHULE KASSEL
Surface Topography of the Lower Part of Co- lumbia Glacier, Alaska, 1974-81,	Area 1,	(GERMANY, F.R.). FACHBEREICH 19 - BIOLOGIE, CHEMIE,
W89-03021 2C	W89-02578 5B	Impairment of Mobility and Development in
Bed Terrority Referred Dec. 411	Geohydrology and Susceptibility of Major	Freshwater Snails (Physa fontinalis and Lym-
Bed Topography Inferred From Airborne Radio-Echo Sounding of Columbia Glacier	Aquifers to Surface Contamination in Alabama,	naea stagnalis) Caused By Herbicides,
Alaska,	Area 6, W89-02590 5B	W89-03290 5C
W89-03022 20	W 89-02390	GOETEBORG UNIV. (SWEDEN). DEPT. OF
GEOLOGICAL SURVEY, TACOMA, WA.	GEOLOGICAL SURVEY, URBANA, IL.	OCEANOGRAPHY.
WATER RESOURCES DIV.	WATER RESOURCES DIV.	Dynamic Control by Topography in Estuaries,
Selected Groundwater Information for the Co		W89-02684 2L
lumbia Plateau Regional Aquifer System, Wash	W89-02484 5B	GOETEBORG UNIV. (SWEDEN), DEPT. OF
ington and Oregon, 1982-1985: Volume I, Geo hydrology,		ZOOPHYSIOLOGY.
W89-02572 76	River Decatur to Riverton Illinois Summer	Physiological Disturbances in Fish Living in Coastal Water Polluted with Bleached Kraft
	1982.	Pulp Mill Effluents, W89-03234 5C
Selected Groundwater Information for the Co	17009	W 67-03234 5C
lumbia Plateau Regional Aquifer System, Wash	- W89-02486 5B	
	- W89-02486 5B	GOETTINGEN UNIV. (GERMANY, F.R.).
lumbia Plateau Regional Aquifer System, Washington and Oregon, 1982-1985: Volume I	W89-02486 5B Hydrology of Area 31, Eastern Region, Interior	GOETTINGEN UNIV. (GERMANY, F.R.). INST. FUER BODENKUNDE UND
lumbia Plateau Regional Aquifer System, Washington and Oregon, 1982-1985: Volume I Water Levels, W89-02573	W89-02486 5B Hydrology of Area 31, Eastern Region, Interior Coal Province, Illinois and Indiana, W89-02508 5B	GOETTINGEN UNIV. (GERMANY, F.R.). INST. FUER BODENKUNDE UND WALDERNAEHRUNG.
lumbia Plateau Regional Aquifer System, Washington and Oregon, 1982-1985: Volume I Water Levels, W89-02573 Quantity and Quality of Storm Runoff from the storm of the storm o	W89-02486 5B Hydrology of Area 31, Eastern Region, Interior Coal Province, Illinois and Indiana, W89-02508 5B	GOETTINGEN UNIV. (GERMANY, F.R.). INST. FUER BODENKUNDE UND WALDERNAEHRUNG. Interactions of Organic Matter and Aluminum
lumbia Plateau Regional Aquifer System, Washington and Oregon, 1982-1985: Volume I Water Levels, W89-02573	W89-02486 Hydrology of Area 31, Eastern Region, Interior Coal Province, Illinois and Indiana, W89-02508 Technique for Estimating Flood-Peak Discharge and Frequencies on Rural Streams in Illinois,	GOETTINGEN UNIV. (GERMANY, F.R.). INST. FUER BODENKUNDE UND WALDERNAEHRUNG.

ILLINOIS UNIV., URBANA. DEPT. OF CIVIL ENGINEERING.

INST., CHUGOKU, KURE (JAPAN).	INST. FUER UMWELTPHYSIK.	(ENGLAND), DEPT. OF GEOGRAPHY.
Mass Balance of Heavy Metals in the Seto	Role of Tracer Data for Modeling Soil-Water	Runoff and Sediment Production in a Small
Inland Sea, Japan,	Flow in the Unsaturated Zone,	Peat-Covered Catchment: Some Preliminary Re-
W89-03278 5B	W89-03013 2G	sults,
CRAY EDECHWATER BIOLOGICAL INCT		W89-02888 2E
GRAY FRESHWATER BIOLOGICAL INST., NAVARRE, MN.	HELSINKI UNIV. (FINLAND). DEPT. OF	
Transport, Bioaccumulation, and Toxicity of	LIMNOLOGY.	Patterns of Hillslope Solutional Denudation in
Metals and Metalloids in Microorganisms under	Ground Water: A Living Ecosystem,	Relation to the Spatial Distribution of Soil Mois-
Environmental Stress,	W89-03084 2F	ture and Soil Chemistry over a Hillslope Hollow
W89-02652 5B	Pi-1-i-1 T	and Spur,
	Biological Treatment of Groundwater in Basins with Floating Filters: II. The Role of Microor-	W89-02906 2J
GREAT LAKES FORESTRY RESEARCH	ganisms in Floating Filters,	
CENTRE, SAULT SAINTE MARIE	W89-03095 5G	HYDRAULICS RESEARCH LTD.,
(ONTARIO).	W 65-03073	WALLINGFORD (ENGLAND),
Limits on Cation Leaching of Weakly Podzo-	HELSINKI UNIV. OF TECHNOLOGY, ESPOO	Extremal Hypotheses Applied to River Regime,
lized Forest Soils: An Empirical Evaluation,	(FINLAND), DEPT, OF ELECTRICAL	W89-02454 2J
W89-02310 5B	ENGINEERING.	
GREATER LONDON COUNCIL (ENGLAND).	Retrieval of Snow Water Equivalent from	Schistosomiasis Control in Irrigation Schemes in
DEPT. OF PUBLIC HEALTH ENGINEERING.	Nimbus-7 SMMR Data,	Zimbabwe,
Assessing the Health Effects of Floods,	W89-02621 7B	W89-03066 5G
W89-02757 2E		IDANIO UNIV. MOSCONI DUDE OF
W 03-02/37	HELSINKI UNIV. OF TECHNOLOGY, ESPOO	IDAHO UNIV., MOSCOW, DEPT. OF
GROUNDWATER TECHNOLOGY, INC.,	(FINLAND), LAB, OF HYDROLOGY AND	AGRICULTURAL ENGINEERING.
SACRAMENTO, CA.	WATER RESOURCES ENGINEERING.	Microcomputer Program Development for On-
Effects of Acid Mine Drainage on Groundwater	Model for Predicting the Effect of Drainage on	Farm Irrigation Systems Planning,
Quality at the Leviathan Sulfur Mine, Alpine	Soil Moisture, Soil Temperature and Crop Yield,	W89-02550 6A
County, California,	W89-03334 4A	THE PLANT OF THE CHICAGO
W89-02363 5C		ILLINOIS INST. OF TECH., CHICAGO.
	HERCULES, INC., WILMINGTON, DE.	PRITZKER DEPT. OF ENVIRONMENTAL ENGINEERING.
GROUNDWATER TECHNOLOGY, INC.,	Process Development and Treatment Plant	
TEMPE, AZ.	Startup for an Explosives Industry Wastewater,	Metal Treatment and Recovery,
In Situ Aquifer Denitrification: Remediation of	W89-02287 5D	W89-02653 5D
Ammonia and Nitrate Contaminated Subsurface		
Environments,	HOCHSCHULE DER BUNDESWEHR	ILLINOIS NATURAL HISTORY SURVEY,
W89-02359 5G	MUENCHEN, NEUBIBERG (GERMANY, F.R.).	CHAMPAIGN.
	INST. FUER WASSERWESEN.	Accounting for Effort When Comparing Tropi-
HANOVER UNIV. (GERMANY, F.R.). INST.	Contribution to Computation of Sedimentation	cal Fisheries in Lakes, River-Floodplains, and
FUER SIEDLUNGSWASSERWIRTSCHAFT	of Solids in Horizontal-Sedimentation basins	Lagoons,
UND ABFALLTECHNIK.	(Ein Beitrag zur Berechnung der Sedimentation	W89-03269 2H
Influence of Sludge from Chemical Biological Wastewater Treatment on Nitrification and Di-	von Feststoffen in Horizontal Durchstromten	
gestion,	Sandfangen), W89-02711 5D	ILLINOIS STATE ENVIRONMENTAL
W89-02816 5D	W89-02/11 5D	PROTECTION AGENCY, SPRINGFIELD. DIV.
W 85-02810	HOELZLE AND CHELIUS G.M.B.H., NEU-	OF WATER POLLUTION CONTROL.
HARBOR BRANCH OCEANOGRAPHIC	ISENBURG (GERMANY, F.R.).	Intensive Survey of the DuPage River Basin,
INSTITUTION, INC., FORT PIERCE, FL.	Studies of Permeation of Gases with Disinfect-	1983.
Laguna Madre of Texas: Hydrography of a Hy-	ing Action Across Polymer Barriers,	W89-02829 5G
persaline Lagoon,	W89-03044 5F	
W89-02695 2L	W 65-03044	Intensive Survey of the Fox River Basin from
	HONG KONG PUBLIC WORKS DEPT.	the Wisconsin State Line to Ottawa, Illinois:
Degradation of Bromoform and Chlorodibromo-	GEOTECHNICAL CONTROL OFFICE.	1982.
methane in a Catalyzed H2-Water System,	Assessment of Hydrogeological Features Using	W89-02841 5G
W89-03311 2K	the Technique of Terrain Classification,	
	W89-02372 7B	Intensive Survey of the Kishwaukee River and
HARRIS CORP., MELBOURNE, FL.		its Tributaries, 1983.
Wastewater Treatment: Optimizing an Existing	HOOFDGROEP MAATSCHAPPELIJKE	W89-02858 5C
System,	TECHNOLOGIE TWO APELDOOPN	
W89-02406 5D	(NETHERLANDS),	Volunteer Lake Monitoring Program, 1987.
HABUARD MEDICAL SCHOOL BOSTON	Anaerobic Treatment of Sulfate-Containing	Volume I: Statewide Summary Report,
HARVARD MEDICAL SCHOOL, BOSTON, MA. DEPT. OF ANAESTHESIA.	Waste Water,	W89-02869 7E
Concentration of Mycobacterium avium by Hos-	W89-02930 5D	
pital Hot Water Systems,		ILLINOIS STATE WATER SURVEY DIV.,
W89-03304 5E	HOOFDGROEP MAATSCHAPPELIJKE	SAVOY, HAZARDOUS WASTE RESEARCH
1107-03304	TECHNOLOGIE TNO, DELFT	AND INFORMATION CENTER.
HARZA ENGINEERING CO., CHICAGO, IL.	(NETHERLANDS).	Preliminary Environmental Assessment of the Contamination Associated with Lake Calumet
Design Problems in Gravel-Bed Rivers, Alaska	Literature Study on the Feasibility of Microbio-	
W89-02458 2	logical Decontamination of Polluted Soils,	Cook County, Illinois,
	W89-02916 5G	W89-02870 51
HAWAII UNIV. AT MANOA, HONOLULU.		ILLINOIS UNIV. AT URBANA-CHAMPAIGN.
DEPT. OF CIVIL ENGINEERING.	HOWARD PLATING INDUSTRIES,	DEPT. OF ATMOSPHERIC SCIENCES.
Solute Transport Modeling in Heterogeneou		
Soils: Conjunctive Application of Physically	Howard Plating Clean Up Their Act with Mag-	
Based and System Approaches,	nesium Hydroxide,	tories, W89-02607
W89-03151 2C	W89-02401 5D	W89-02607
	TIRE LOCALITIES THE STATE STATE	HILINOIS UNIV LIBRANA DERT OF CUIT
HEBREW UNIV., JERUSALEM (ISRAEL).	HRP ASSOCIATES, INC., NEW BRITAIN, CT.	ILLINOIS UNIV., URBANA. DEPT. OF CIVIL
INST. OF EARTH SCIENCES.	How Clean Is Clean. (What Constitutes the	
Bed Load Transport in Desert Floods: Observa		
tions in the Negev,	agement Facility),	Chemicals with Biological Processes, W89-02929 51
W89-02450 2	W89-02399 5E	H 07-04747 31

IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND). DEPT. OF

IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND). DEPT. OF CIVIL ENGINEERING.	Sensitivity Analysis of Adsorption and Degrada- tion Parameters in the Modeling of Pesticide Transport in Soils,	INSTITUTUL DE METEOROLOGIE SI HIDROLOGIE, BUCHAREST (ROMANIA). Isotopic Investigation on the Evolution of
Hydrology in Practice, W89-02421 2A	W89-03150 2G	Groundwater Dynamics in the Principal Aquifers in the Southern Dobrudja,
IMPERIAL COLL, OF SCIENCE AND	Effect of pH on Iron and Manganese Uptake by	W89-02853 2F
TECHNOLOGY, LONDON (ENGLAND).	a Green Alga, W89-03246 5C	INTERNATIONAL ASSOCIATION OF
DEPT. OF PURE AND APPLIED BIOLOGY. Remote Sensing.		HYDROGEOLOGISTS, PARIS (FRANCE).
W89-02761 7B	INSTITUTE FOR MARINE ENVIRONMENTAL RESEARCH, PLYMOUTH	Report on Hydrogeological Maps of Karstic Terrains,
Salt Marshes, W89-02762 7B	(ENGLAND). Tidal Dynamics of Estuaries,	W89-02389 2F
	W89-02687 2L	Hydrogeological Maps from the View-Point of
INDIAN INST. OF TECH., BOMBAY. CENTRE FOR ENVIRONMENTAL SCIENCE	INSTITUTE FOR SOIL FERTILITY, HAREN	the User,
AND ENGINEERING. Evaluation of Sludge Settleability be Floc Char-	(NETHERLANDS).	W89-02391 7A
acteristics,	Meiofauna, W89-02766 2L	INTERNATIONAL ATOMIC ENERGY
W89-03167 5D	DIGHT THE OF BYONINGS	AGENCY, VIENNA (AUSTRIA). Mathematical Models for Interpretation of
INDIANA UNIV. AT BLOOMINGTON. DEPT. OF BIOLOGY.	INSTITUTE OF BIOPHYSICS, KRASNOYARSK (USSR).	Tracer Data in Groundwater Hydrology.
Aquatic Macrophytes in Adirondack (New	Prediction of Reservoir Phytoplankton Condi- tion by the Fluorescence Method,	W89-03009 2F
York) Lakes: Patterns of Species Composition in Relation to Environment,	W89-03291 2H	INTERNATIONAL ATOMIC ENERGY
W89-03056 5C	INSTITUTE OF HYDROLOGY, POWYS	AGENCY, VIENNA (AUSTRIA), DIV. OF RESEARCH AND LABS.
INGENIEURBUERO FUER	(WALES).	Use of Linear Compartmental Simulation Ap-
VERFAHRENSTECHNIK, WIESBADEN	Development of Field Techniques for Assess-	proach for Quantitative Interpretation of Isotope
(GERMANY, F.R.). Synergistic Approach to Physical-Chemical	ment of River Erosion and Deposition in Mid- Wales, UK,	Data under Time Variant Flow Conditions, W89-03017 7C
Wastewater Pretreatment in the Food Industry, W89-02802 5D	W89-02898 2J	1107-03017
	INSTITUTE OF HYDROLOGY, POWYS	INTERNATIONAL INST. FOR APPLIED
INLAND WATERS DIRECTORATE, VANCOUVER (BRITISH COLUMBIA).	(WALES), FLUVIAL GEOMORPHOLOGY	SYSTEMS ANALYSIS, LAXENBURG (AUSTRIA).
PACIFIC AND YUKON REGION.	UNIT. Transport Processes at the Catchment Scale,	Attempt to Facilitate Water Management Issues
Evaluation of the Acute Toxicity to Juvenile Pacific Salmonids of Hexazinone and its Formu-	W89-02437 2J	in the Zambezi River Basin Using Decision Sup- port Systems,
lated Products: Pronone 10G, Velpar L, and Their Carriers,	INSTITUTE OF HYDROLOGY,	W89-03145 5G
W89-03316 5C	WALLINGFORD (ENGLAND).	INTERNATIONAL SCHOLARS FOR
INNSBRUCK UNIV, (AUSTRIA), INST. FUER RADIOCHEMIE UND ANGEWANDTE PHYSIKALISCHE CHEMIE.	Modelling a Seasonal Snow Cover, W89-02627 2C	ENVIRONMENTAL STUDIES, 107 CANNER STREET, NEW HAVEN, CONNECTICUT 06511.
Analysis of Volatile Halogenated Hydrocarbons on the ppq Scale,	Flood Insurance and Floodplain Management, W89-02750 6F	Review of Environmental Toxicity of Quater- nary Ammonium Halides,
W89-03301 5A	INSTITUTE OF NUCLEAR PHYSICS,	W89-03298 5C
INSINOORI- JA LIMNOLOGITOIMISTO OY	KRAKOW (POLAND).	TATERNIA PRODUCE A SIE
VESITEKNIIKKA A.B., SALPAKANGAS (FINLAND).	Review of Existing Mathematical Models for Interpretation of Tracer Data in Hydrology,	INTERNATIONAL SCIENCE AND TECHNOLOGY, INC., RESTON, VA.
Application of Environmental Risk Analysis to Groundwater Protection, W89-03083 5G	W89-03012 2F INSTITUTE OF PHYSICS AND NUCLEAR	Maryland Synoptic Stream Chemistry Survey: Estimating the Number and Distribution of Streams Affected By or At Risk from Acidifica-
	TECHNIQUES, KRAKOW (POLAND).	tion,
INSTITUT DE MECANIQUE DE GRENOBLE, SAINT-MARTIN D'HERES (FRANCE).	Deuterium Isotope Composition of Palaeoinfil- tration Waters Trapped in Speleothems,	W89-02846 5B
Seismic Refraction Tests Above Water Table, W89-03113	W89-02981 5A	IOWA DEPT. OF NATURAL RESOURCES,
INSTITUT FUER BIOTECHNOLOGIE.	INSTITUTE OF TERRESTRIAL ECOLOGY,	DES MOINES. ENVIRONMENTAL PROTECTION DIV.
LEIPZIG (GERMAN D.R.)	EDINBURGH (SCOTLAND). Consequences of Cloud Water Deposition on	Pesticide and Synthetic Organic Compound Survey: Report to the Iowa General Assembly
Aerobic Treatment of Sewage from Lignite (Brown Coal) Processing,	Vegetation at High Elevation,	on the Results of the Water System Monitoring
W89-02915 5D	W89-02305 5B	Required by House File 2303. W89-02836 5F
INSTITUT NATIONAL DE LA RECHERCHE	INSTITUTE OF TROPICAL FORESTRY, RIO	W89-02836 5F
SCIENTIFIQUE, SAINTE-FOY (QUEBEC). Syntrophic Bacteria Process to Convert a Pulp	PIEDRAS, PR. Forested Wetlands in Freshwater and Salt-	IOWA STATE UNIV., AMES.
Mill's Spent Sulphite Liquor to Hydrogen Sul-	Water Environments,	Assessing Some Potentials for Changing Agro- nomic Practices and Improving Ground Water
phide, W89-03115 5D	W89-03265 2H	Quality: Implications from a 1984 Iowa Survey,
Modeling of Total Nitrogen in River Using the	INSTITUTO NACIONAL DE TOXICOLOGIA, SEVILLE (SPAIN).	W89-02669 5G
Quantity-Quality Model CEQUEAU (Modelisa- tion de l'Azote Total en Riviere a l'Aide du	In Vivo and In Vitro Effect of Triclorfon on	IOWA UNIV., IOWA CITY, DEPT. OF CIVIL
Modele Quantite-Qualite CEQUEAU),	Esterases of the Red Crayfish Procambarus clar-	AND ENVIRONMENTAL ENGINEERING. Processes, Coefficients, and Models for Simulat-
W89-03130 5B	kii, W89-03314 5C	ing Toxic Organics and Heavy Metals in Surface
Index of Water Quality Permitting Environmen-		Waters, W89-02788 5B
tal Follow-up and Assessment of Local Impacts (Indice de Qualite de l'Eau Permettant le Suivi	INSTITUTUL DE GEOGRAFIE, BUCHAREST (ROMANIA).	
Environnemental et la Mesure des Impacts	Sources of Sediment and Channel Changes in	Predicting the Effects of a Pesticide Release to the Rhine River.
Locaux), W89-03131 5C	Small Catchments of Romania's Hilly Regions, W89-02896 2J	W89-03159 5C

ISTITUTO DI RICERCA SULLE ACQUE,	Pretreatment of Wastewater from the Automo-	KUSLER (J. A.) ASSOCIATES, CHESTER, VT.
BARI (ITALY). Application of a Transport-Diffusion Model to a Coastal Aquifer Utilizing In situ Measurements	bile Industry, W89-02804 5D	Design Standards for Building in Flood Hazard Areas: A Critical Look at US Experience and Possible Applications Abroad,
of Dispersivity, W89-03016 2F	KEMIJSKI INST. BORIS KIDRIC, LJUBLJANA (YUGOSLAVIA).	W89-02751 4A
	Comparison Between Waste Water Treatment in	PLOTO INTO (IABAN) DICAMPEN
Influence of Na and Ca Alkalinity on UASB Treatment of Olive Mill Effluents: I. Preliminary	Completely Mixed and Fluidized Bed Reactors: Development and Structure of Biomass (Verg-	KYOTO UNIV. (JAPAN). DISASTER PREVENTION RESEARCH INST. Mountain Torrent Erosion,
Results, W89-03116 5D	leich der Absasserreinigung im Ruhr - und im Wirbelbettreaktor Sowie Entwicklung und	W89-02447 2J
IT CORP., KNOXVILLE, TN. Selection Guide for Volatilization Technologies	Struktur der Biomasse), W89-03045 5D	Some Relationships Between Debris Flow Motion and Micro-Topography for the Kamika-
for Water Treatment, W89-02863 5F	KENT STATE UNIV., OH. DEPT. OF BIOLOGICAL SCIENCES.	mihori Fan, North Japan Alps, W89-02907 2J
IT CORP. MONPOEULLE DA	Comparison of Phosphorus Dynamics in Two	
IT CORP., MONROEVILLE, PA. Developing a State Ground Water Policy in the Corn Belt: the Iowa Case.	Oklahoma Reservoirs and a Natural Lake Vary- ing in Abiogenic Turbidity,	KYOTO UNIV., OTSU (JAPAN). OTSU HYDROBIOLOGICAL STATION.
W89-02681 2F	W89-03232 2H	Microflagellate-Picoplankton Food Linkage in the Water Column of Lake Biwa,
JEFFERSON PARISH DEPT. OF PUBLIC UTILITIES, LA.	KIEL UNIV. (GERMANY, F.R.). INST. FUER MEERESKUNDE.	W89-03245 2H
Experiences with Granular Activated Carbon Filtration and On-Site Reactivation at Jefferson Parish, Louisiana,	Effects of Water Soluble Crude Oil Fractions on Cirral Beat Frequency in Balanus balanoides, W89-03205 5C	LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, PALISADES, NY.
W89-02790 5F		Snow Watch '85.
	KOREAN INST. OF ENERGY AND	W89-02606 2C
JOHNS HOPKINS UNIV., BALTIMORE, MD. From Filters to Forests: Water Treatment and	RESOURCES, SEOUL (REPUBLIC OF KOREA). APPLIED GEOLOGY DIV.	Progression of Regional Snow Melt,
Supply, W89-02792 5F	Review of Groundwater in the Republic of Korea,	W89-02610 2C
	W89-02376 2F	Kinetic Control of Dissolved Phosphate in Natu-
JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF GEOGRAPHY AND ENVIRONMENTAL ENGINEERING.	KROFTA ENGINEERING CORP., LENOX, MA.	ral Rivers and Estuaries: A Primer on the Phos- phate Buffer Mechanism,
Introduction to Interactions of Organic Com-	Treatment of Rome Raw Water by Krofta Sand-	W89-03253 2K
pounds with Mineral Surfaces, W89-02643 5B	float Process System Project Documentation (Part A),	LANCASTER UNIV. (ENGLAND), DEPT. OF
	W89-02941 5F	GEOGRAPHY.
JOHNS HOPKINS UNIV., SHADY SIDE, MD. ENVIRONMENTAL SCIENCES GROUP.	Treatment of Rome Raw Water by Krofta Sand-	Alkalinity Measurements in Karst Water Stud- ies,
Toxicity of DEGDN, Synthetic-HC Smoke Combustion Products, Solvent Yellow 33 and	float Process System - Project Documentation (Part B).	W89-02729 2F
Solvent Green 3 to Freshwater Aquatic Organisms,	W89-02942 5F	Kamenitzas of Gait Barrows National Nature Reserve, North Lancashire, England,
W89-02936 5C	Treatment of Rome Raw Water by Krofta Sand- float Process System Project Documentation	W89-02741 2F
JOINT INST. FOR THE STUDY OF THE	(Part C),	LAND DEVELOPMENT DEPT., BANGKOK
ATMOSPHERE AND OCEAN, SEATTLE, WA. Numerical Model for the Computation of Radi-	W89-02943 5F	(THAILAND). SOIL SURVEY DIV.
ance Distributions in Natural Waters with Wind-	Treatment of Farnham and Ashley Reservoir	Status of Hydrogeological Mapping in Thailand, W89-02384 2F
Roughened Surfaces, Part II: User's Guide and Code Listing,	Water by Krofta Sandfloat Process System Project Documentation,	
W89-02414 2H	W89-02950 5F	LANDESAMT FUER WASSERWIRTSCHAFT RHEINLAND-PFALZ, MAINZ (GERMANY,
JONKERSHOEK FOREST RESEARCH STATION, STELLENBOSCH (SOUTH	Treatment of Farnham and Ashley Reservoir	
AFRICA).	Water by Krofta Sandfloat Process System Final Project Report,	parison to the AAS, Photometry, and Millival-
River Response to Catchment Conditions, W89-02990 2H	W89-02951 5F	mit der ICP-AES im Vergleich zur AAS, Pho-
KANSAS DEPT. OF HEALTH AND	Development of an Innovative and Cost-Effec- tive Municipal-Industrial Waste Treatment	
ENVIRONMENT, TOPEKA. DIV. OF ENVIRONMENT.	System,	
Pesticides in Fish Tissue and Water from Tuttle	W89-02960 5D	LAVAL UNIV., QUEBEC, DEPT. DE BIOLOGIE.
Creek Lake, Kansas, W89-03317 5B	Preliminary Design Report of a 10-MGD Deep Shaft-Flotation Plant for the City of Bangor,	
KANSAS STATE UNIV., MANHATTAN. DIV.	Maine, USA: Appendix. W89-02996 5D	Lawrence Estuary, Quebec,
OF BIOLOGY. Hydrologic and Riparian Influences on the	W89-02996 5D	W89-03055 2L
Import and Storage of Coarse Particulate Or- ganic Matter in a Prairie Stream,	Treatment of Potable Water from Seoul, Korea by Flotation, Filtration and Adsorption,	of Phytoplankton and Light Ream Transmission
W89-03214 2H	W89-03319 5F	with Reference to Fluorescence Yield,
KANSAS UNIV., LAWRENCE. DEPT. OF	KUOPIO WATER DISTRICT OFFICE	W89-03233 2L
CIVIL ENGINEERING. Leachate Collection in Landfills: Steady Case,	(FINLAND). Utilization of Biological Methods in Groundwat-	LAVAL UNIV., QUEBEC, DEPT. OF CIVIL
W89-03102 5E	er Treatment, W89-03088 5F	ENGINEERING.
KARLSRUHE UNIV. (GERMANY, F.R.), INST.	# 07-03000 SP	Regime of a Shoreline in the Middle Saint Law-
FUER SIEDLUNGSWASSERWIRTSCHAFT. Pretreatment of Industrial Wastewater: Legal	Biological Treatment of Groundwater in Basins with Floating Filters: I. Test Arrangements and	Regime Morpho-Sedimentologique d'un Estran
and Planning AspectsA Case Study, W89-02800 5D	General Results, W89-03094 5F	de l'Estuaire Moyen du Saint-Laurent), W89-03133

2J

LEGGETTE, BRASHEARS AND GRAHAM, INC., ALBUQUERQUE, NM.

LEGGETTE, BRASHEARS AND GRAHAM, INC., ALBUQUERQUE, NM.	Two Test Procedures for Radon in Drinking Water: Interlaboratory Collaborative Study,	Comparison of Lake Sediments and Ombrotro- phic Peat Deposits as Long-Term Monitors of
Transition from Ground-Water Mining to In-	W89-02956 5A	Atmospheric Pollution,
duced Recharge in Generalized Hydrogeologic		W89-02321 5A
Systems, W89-02337 4B	LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE (ENGLAND), DEPT.	MANCHESTER POLYTECHNIC (ENGLAND).
LENOX INST. FOR RESEARCH, INC., MA.	OF TROPICAL HYGIENE. Engineering, Mosquitoes and Filariasis: A Case	DEPT. OF ENVIRONMENTAL AND
Simplified Laboratory Procedures for DO De-	Report.	GEOGRAPHICAL STUDIES.
termination (APHA/AWWA/ WPCF Method),	W89-03065 5G	Stormflow Characteristics of Three Small Lime-
W89-02958 7B		stone Drainage Basins in North Island, New Zealand.
	LONDON UNIV. (ENGLAND). DEPT. OF	W89-02735 2A
Recent Advances in Magnetic Processes,	GEOGRAPHY.	W 65-02/33
W89-02961 5D	Chemical Weathering of the East Yorkshire	MANCHESTER UNIV. (ENGLAND), DEPT, OF
Emissions and Control of Offensive Odor in	Chalk, W89-02731 2K	BOTANY.
Wastewater Treatment Plants,	W89-02/31	Responses to Acidic Deposition in Ombotrophic
W89-02962 5D	LOS ANGELES CITY DEPT. OF WATER AND	Mires in the U.K.,
110702702	POWER, CA.	W89-02314 5B
BOD and Nutrient Removal by Biological A/O	Use of Well Packers To Control TCE and PCE	
Process Systems,	Contaminants,	MANCHESTER UNIV. (ENGLAND). DEPT. OF
W89-03326 5D	W89-02356 5G	GEOGRAPHY.
	CONTRACTOR OF STREET STREET STREET STREET	Snow and Ice,
LEWIN FRYER AND PARTNERS, HAMPTON (ENGLAND).	LOUISIANA STATE UNIV., BATON ROUGE. CENTER FOR WETLAND RESOURCES.	W89-02722 2C
Valves in Reservoir Outlets,	Causes of Wetland Loss in the Coastal Central	
W89-03072 8C	Gulf of Mexico. Volume 2: Technical Narrative.	Hydrology and Hydrologists,
1107-03012	W89-02878 4C	W89-02727 2A
LIMNOLOGISCH INST., NIEUWERSLUIS		MANUFORA UNIV. WINDUPED DEPT OF
(NETHERLANDS). VIJVERHOF LAB.	Freshwater and Marine Coupling in Estuaries of	MANITOBA UNIV., WINNIPEG. DEPT. OF BOTANY.
Effects of Cadmium Exposure on Feeding of	the Mississippi River Deltaic Plain,	Sources of Alkalinity in Precambrian Shield Wa-
Freshwater Planktonic Crustaceans,	W89-03271 2E	tersheds Under Natural Conditions and After
W89-03288 5C	TOTAL STATE TO THE PARTY PARTY PARTY	Fire or Acidification,
I INCOLN COLL CANTERDURY OFFW	LOUISIANA STATE UNIV., BATON ROUGE, COASTAL ECOLOGY LAB.	W89-02313 2G
LINCOLN COLL., CANTERBURY (NEW ZEALAND), DEPT. OF AGRICULTURAL	Causes of Wetland Loss in the Coastal Central	
ENGINEERING.	Gulf of Mexico. Volume 3. Appendices.	MARIE CURIE-SKLODOWSKA UNIV.,
Problems of Bed Load Transport in Braided	W89-02879 4C	LUBLIN (POLAND). INST. OF CHEMISTRY.
Gravel-Bed Rivers,		New Porous Polymer for Off-Line Preconcen-
W89-02455 2J	LOUISIANA STATE UNIV., BATON ROUGE.	tration of Chlorophenols from Water,
	LAB. FOR WETLAND SOILS AND	W89-03286 5A
LINKOEPING UNIV. (SWEDEN). DEPT. OF	SEDIMENTS.	
WATER IN ENVIRONMENT AND SOCIETY.	Response of Coastal Plants to Increase in Sub-	MARINE BIOLOGICAL ASSOCIATION OF
Odour Control by Artificial Groundwater Re-	mergence and Salinity,	THE UNITED KINGDOM, PLYMOUTH
charge, W89-02799 5F	W89-03188 2L	(ENGLAND).
W 69-02179	LUND UNIV. (SWEDEN). METAL ECOLOGY	Fish (Survey of),
LITTLE (ARTHUR D.), INC., CAMBRIDGE,	GROUP.	W89-02771 7E
MA.	Soil Acidification and Metal Solubility in For-	MARINE BIOLOGICAL LAB WOODS HOLE
Economic Evaluation of Carbon Adsorption/	ests of Southern Sweden,	MARINE BIOLOGICAL LAB., WOODS HOLE MA. ECOSYSTEMS CENTER.
Ion Exchange Wastewater Treatment Options	W89-02308 5B	Comparison of the Ecology of Planktonic Bacte
for Sunflower AAP NQ Wastewater Treatment		ria in Fresh and Salt Water,
Facility,	LYONNAISE DES EAUX, LE PECQ	W89-03258 2H
W89-02828 5D	(FRANCE). DEPT. OF WASTEWATER	
Engineering/Cost Evaluation of Options for Re-	TREATMENT. Enhanced Biological Phosphorus Removal from	MARINE LAB., ABERDEEN (SCOTLAND).
moval/Disposal of NC Fines,	Waste Waters,	Extraction, Clean-up and Group Separation
W89-02933 5D	W89-02931 5D	Techniques in Organochlorine Trace Analysis
		W89-03068 5A
LIVERPOOL UNIV. (ENGLAND), DEPT. OF	LYONNAISE DES EAUX, PARIS (FRANCE).	
GEOGRAPHY.	Vulnerability Study of the Aubergenville Aqui-	MARYLAND GEOLOGICAL SURVEY,
Sediment Supply to Upland Streams: Influence	fer,	BALTIMORE.
on Channel Adjustment,	W89-03077 5B	Selected Geohydrologic Characteristics of th
W89-02435 2J	MARRIETT CARACTO AND ACCOUNTING	Patapsco Aquifer at Chalk Point, Prince
LIVERPOOL UNIV. (ENGLAND), DEPT, OF	MABBETT, CAPACCIO AND ASSOCIATES, INC., CAMBRIDGE, MA.	Georges County, Maryland,
ZOOLOGY.	Environmental Auditing: Management's Key to	W89-02560 21
Fish Populations of a Small Lowland Channel-	Effective Environmental Compliance,	MARVI AND UNIV CAMPRIDGE HORN
ized River in England Subject to Long-Term	W89-02409 6A	MARYLAND UNIV., CAMBRIDGE, HORN POINT ENVIRONMENTAL LABS.
River Maintenance and Management Works,		Comparative Ecology of Submersed Grass Bed
W89-03139 6G	MACDONALD COLL., STE. ANNE DE	in Freshwater, Estuarine, and Marine Environ
V HIDT VANA VINING ARROAD ARRAY	BELLEVUE (QUEBEC), DEPT. OF FOOD	ments,
LJUBLJANA UNIV. (YUGOSLAVIA).	SCIENCE AND AGRICULTURAL	W89-03264 21
FACULTY OF MECHANICAL ENGINEERING. Developments in the Design of Bulb Turbines.	CHEMISTRY.	
W89-03069 8C	Chromatographic Approaches to Trace Element Speciation,	MARYLAND UNIV., COLLEGE PARK. DEPT.
- C	W89-02648 5A	OF METEOROLOGY.
LOCKHEED ENGINEERING AND	38	Comparison of Northern Hemisphere Snov
MANAGEMENT SERVICES CO., INC., LAS	MAINE UNIV. AT ORONO. DEPT. OF	Cover Data Sets,
VEGAS, NV.	GEOLOGICAL SCIENCES.	W89-02619 76
National Surface Water Survey, Western Lake	Stratigraphic Record of Atmospheric Loading	
Survey (Phase I - Synoptic Chemistry) Quality	of Metals at the Ombrotrophic Big Heath Bog,	Effects of Snow Cover and Tropical Forcing of
Assurance Plan, W89-02413 2H	Mt. Desert Island, Maine, U.S.A., W89-02315	Mid-Latitude Monthly Mean Circulation, W89-02625

MINISTRY OF WORKS AND DEVELOPMENT, HAMILTON (NEW ZEALAND). WATER QUALITY

MARYLAND WATER RESOURCES ADMINISTRATION, ANNAPOLIS. FLOOD	MCMASTER UNIV., HAMILTON (ONTARIO). DEPT. OF CIVIL ENGINEERING AND	Social Choice and Benefit-Cost Analysis, W89-02756 6B
MANAGEMENT DIV. Floodplain Mapping and Beyond: A State Per-	ENGINEERING MECHANICS. Behaviour of Buried Small Flexible Pipes,	MILLIKEN CHAPMAN RESEARCH GROUP,
spective, W89-02755 6F	W89-03137 8G	INC., LITTLETON, CO. Water Management Issues in the Denver, Colo-
	MENOUFIA UNIV., SHIBIN AL-KOM	rado, Urban Area,
MASSACHUSETTS INST. OF TECH.,	(EGYPT), DEPT. OF ZOOLOGY.	W89-02638 6D
CAMBRIDGE, DEPT, OF CIVIL ENGINEERING.	Effect of Impoundment on the Growth of Bagrus docmac in Lake Nasser,	
Biogeochemistry of Lead-210 and Polonium-210	W89-03143 6G	MINISTRY OF AGRICULTURE AND WATER DEVELOPMENT, LUSAKA (ZAMBIA).
in Fresh Waters and Sediments,	10000 AND 100000 AND 100000 AND 100000	Environmental Management of the Zambezi
W89-02555 2K	MERZ AND MCLELLAN, NEWCASTLE UPON TYNE (ENGLAND).	River System,
MASSACHUSETTS UNIV., AMHERST. DEPT.	Extending the Operating Life of Hydro Equip-	W89-03144 5G
OF CIVIL ENGINEERING.	ment,	MINISTRY OF AGRICULTURE, FISHERIES
Microtox Assessment of Anaerobic Bacterial Toxicity,	W89-03156 8C	AND FOOD, CAMBRIDGE (ENGLAND).
W89-02301 5D	METROPOLITAN SANITARY DISTRICT OF	FIELD DRAINAGE EXPERIMENTAL UNIT.
MAGGACIENTO PRINTE AMELIENCE DEPT	GREATER CHICAGO, IL. Tunnel and Reservoir Plan Solution to Chica-	Hydrology and Water Quality of a Drained Clay Catchment, Lockle Park, Northumberland,
MASSACHUSETTS UNIV., AMHERST. DEPT. OF GEOLOGY AND GEOGRAPHY.	go's Combined Sewer Overflow, Basement	W89-02889 2E
Flood Loss Reduction by Metropolitan Regional	Flooding, and Pollution,	
Authorities in the United States,	W89-03134 4A	MINISTRY OF AGRICULTURE, FISHERIES
W89-02752 6E	MICHIGAN STATE UNIV., HICKORY	AND FOOD, LONDON (ENGLAND), Urban Flood Problems: Their Scale and the
MASSACHUSETTS UNIV., AMHERST.	CORNERS. W.K. KELLOGG BIOLOGICAL	Policy Response,
WATER RESOURCES RESEARCH CENTER.	STATION.	W89-02746 4A
Fiscal Year 1986 Program Report (Massachu- setts Water Resources Research Center),	Phosphorous Flux from Lake Sediments: Effect of Epipelic Algal Oxygen Production,	MINISTRY OF AGRICULTURE, JERUSALEM
W89-02587 9D	W89-03248 2H	(ISRAEL), HYDROLOGICAL SERVICE,
ALLERDON DIG ALLERDA GA	Mana IV Translat octate the	Groundwater Contamination by Nitrates and
MATRECON, INC., ALAMEDA, CA. Factors in Assessing the Compatibility of FMLs	MICHIGAN TECHNOLOGICAL UNIV., HOUGHTON.	Chlorides Washed out from Phosphorite Ores in
and Waste Liquids,	Use of Rapid Small-Scale Column Tests to Pre-	the Negev Desert, Israel, W89-03147 5B
W89-02952 5E	dict Full-Scale Adsorption Capacity and Per-	W 67-03147
MCGILL UNIV., MONTREAL (QUEBEC).	formance, W89-02789 5F	MINISTRY OF FORESTRY AND WATER
DEPT. OF BIOLOGY.	W 69-02769	CONSERVANCY, PRAGUE
Littoral Zoobenthic Biomass in Lakes, and Its	MICHIGAN TECHNOLOGICAL UNIV.,	(CZECHOSLOVAKIA). Problems in Czechoslovakia Regarding Methods
Relationship to Physical, Chemical, and Trophic Factors,	HOUGHTON, DEPT, OF BIOLOGICAL SCIENCES.	of Removal of Nitrates from Drinking Water
W89-03229 2H	Monitoring and Quality Assurance Procedures	W89-03098 5D
	for the Study of Remote Watershed Ecosystems,	MINISTRY OF GEOLOGY AND MINERALS.
MCGILL UNIV., MONTREAL (QUEBEC), INST. OF OCEANOGRAPHY.	W89-02330 5A	BEIJING (CHINA). ADVISORY COMMITTEE
Change in Sedimentation Following River Di-	MICHIGAN UNIV., ANN ARBOR, DEPT. OF	ON GEOLOGY SCIENCE AND
version in the Eastmain Estuary (James Bay),	BIOLOGY.	TECHNOLOGY.
Canada, W89-03186 2J	Comparative Ecology of Marine and Freshwater	Development and Achievements of Hydrogeo- logical Mapping in China,
W 07-03160 23	Phytoplankton, W89-03260 2H	W89-02370 2F
MCMASTER UNIV., HAMILTON (ONTARIO).		
DEPT. OF BIOLOGY. Long-Term Sublethal Acid Exposure in Rain-	Ecological Principles Affecting Community	MINISTRY OF LANDS, ENERGY AND NATURAL RESOURCES, HONIARA
bow Trout (Salmo gairdneri) in Soft Water:	Structure and Secondary Production by Zoo- plankton in Marine and Freshwater Environ-	(SOLOMON ISLANDS).
Effects on Ion Exchanges and Blood Chemistry,	ments,	Position Paper: Solomon Islands,
W89-03226 5C	W89-03267 2H	W89-02367 28
Effects of Aluminum and Low pH on Net Ion	MICHIGAN UNIV., ANN ARBOR, GREAT	MINISTRY OF WATER ECONOMY, ULAN
Fluxes and Ion Balance in the Brook Trout	LAKES RESEARCH DIV.	BATOR (MONGOLIA).
(Salvelinus fontinalis), W89-03235 5C	Silica and Phosphorus Flux from Sediments: Im-	Water Resources and Hydrogeological Mapping
	portance of Internal Recycling in Lake Michi- gan,	in the Mongolian People's Republic, W89-02379
Blood Gases, Acid-Base Status, Ions, and Hema-	W89-03219 2H	W 69-02379
tology in Adult Brook Trout (Salvelinus fontina- lis) Under Acid/Aluminum Exposure,	Setiment Board of Birms having Borrows	MINISTRY OF WORKS AND
W89-03236 5C	Sediment Record of Biogeochemical Responses to Anthropogenic Perturbations of Nutrient	DEVELOPMENT, CHRISTCHURCH (NEW ZEALAND).
	Cycles in Lake Ontario,	Rapid Subsurface Flow and Streamflow Solut
Physiological Evidence of Acclimation to Acid/ Aluminum Stress in Adult Brook Trout (Salve-	W89-03222 2H	Losses in a Mixed Evergreen Forest, New Zea
linus fontinalis): I. Blood Composition and Net	MIDDLESEX POLYTECHNIC, LONDON	land,
Sodium Fluxes,	(ENGLAND). FLOOD HAZARD RESEARCH	W89-02890 20
W89-03237 5C	CENTRE.	MINISTRY OF WORKS AND
Physiological Evidence of Acclimation to Acid/	Flood Problem in Perspective, W89-02744 4A	DEVELOPMENT, CHRISTCHURCH (NEW
Aluminum Stress in Adult Brook Trout (Salve-		ZEALAND), HYDROLOGY CENTRE.
linus fontinalis): II. Blood Parameters by Cannu-	Institutional and Policy Context,	Field Measurements in a Gravel-bed Rive which Confirm the Theory of White et al.,
lation, W89-03238 5C	W89-02745 6F	W89-02446 2
	Power Behind the Flood Scene,	LONGO OF WORKS
Sodium Transport in the Brook Trout, Salve- linus fontinalis: Effects of Prolonged Low pH	W89-02747 6E	MINISTRY OF WORKS AND DEVELOPMENT, HAMILTON (NEW
Exposure in the Presence and Absence of Alu-	Flood Warning Dissemination: The British Ex-	ZEALAND). WATER QUALITY CENTRE.
minum,	perience,	Measuring Water Clarity with a Black Disl
W89-03239 5C	W89-02753 6F	W89-03251 7

MINISTRY OF WORKS AND DEVELOPMENT, LOWER HUTT (NEW ZEALAND). CENTRAL

MINISTRY OF WORKS AND DEVELOPMENT, LOWER HUTT (NEW	MUNICIPAL ENVIRONMENTAL RESEARCH LAB., CINCINNATI, OH. WASTEWATER	NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE,
ZEALAND). CENTRAL LABS. Sediment Transport in Step-Pool Streams,	RESEARCH DIV. Computer Aided Design of Diffused Aeration	WASHINGTON, DC.
W89-02448 2J	Systems, W89-02947 5D	Northern Hemisphere Snow and Ice Chart of NOAA/NESDIS,
MINNESOTA UNIV., MINNEAPOLIS. DEPT.	W 07-02547	W89-02616 2C
OF CIVIL AND MINERAL ENGINEERING. Proton Cycling in Bogs: Geographical Variation	NAGOYA UNIV. (JAPAN). WATER RESEARCH INST.	NOAA Satellite-Derived Snow Cover Data
in Northeastern North America, W89-02316 5B	Change in Distribution Patterns of Photosynthe- tically Incorporated C during Phytoplankton	Base: Past, Present, and Future, W89-02617 2C
Temperature Dependence of Liquid Film Coefficient for Gas Transfer,	Bloom in Controlled Experimental Ecosystem, W89-03059 2L	Snow Cover Monitoring Using Microwave Ra-
W89-03112 2K	NAIROBI UNIV. (KENYA). DEPT. OF METEOROLOGY.	diometry, W89-02623 7B
MINNESOTA UNIV., MINNEAPOLIS. DEPT. OF ECOLOGY AND BEHAVIORAL	Eurasian Snow Cover and Seasonal Forecast of Indian Summer Monsoon Rainfall,	Nimbus-7 Global Cloud Climatology: Part I. Algorithms and Validation,
Natural and Anthropogenic Acidification of	W89-03054 2B	W89-03307 2B
Peatlands, W89-02311 5B	NATAL UNIV., PIETERMARITZBURG (SOUTH AFRICA), DEPT, OF ZOOLOGY,	NATIONAL ENVIRONMENTAL SATELLITE,
MINNESOTA UNIV., ST. PAUL. DEPT. OF FOREST RESOURCES.	Uses of, and Human Impact on Rivers, W89-02988 4C	DATA, AND INFORMATION SERVICE, WASHINGTON, DC. CLIMATE ANALYSIS CENTER.
Innovative Designs for Water Quality Monitor- ing: Are We Asking the Questions Before the Data Are Collected,	NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM, WASHINGTON,	Snow Cover in Real Time Monitoring, W89-02615 2C
W89-02320 7A	DC. Directory of Precipitation Monitoring Sites, Na-	NATIONAL FISHERIES RESEARCH
MISSISSIPPI STATE UNIV., MISSISSIPPI STATE. WATER RESOURCES RESEARCH	tional Atmospheric Deposition Program/Na- tional Trends Network (NADP/NTN).	CENTER-GREAT LAKES, ANN ARBOR, MI. Effect of Submersed Aquatic Macrophytes on
INST. Proceedings, Seventeenth Mississippi Water Re-	W89-02480 7A	Resource Partitioning in Yearling Rock Bass
sources Conference, 25-26 March, 1987, Jackson, Mississippi.	NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM, WASHINGTON,	(Ambloplites rupestris) and Pumpkinseeds (Le- pomis gibbosus) in Lake St. Clair,
W89-02476 6B	DC. OFFICE OF THE DIRECTOR OF RESEARCH.	W89-03171 2H
MIYAZAKI UNIV. (JAPAN). DEPT. OF CIVIL	National Acid Precipitation Assessment Pro-	Toxicity of Six Heterocyclic Nitrogen Com-
ENGINEERING. Reuse of Chemical Sludge for Conditioning of Biological Sludges,	gram: Annual Report, 1986. W89-02873 5B	pounds to Daphnia pulex, W89-03315 5C
W89-02815 5D	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GREENBELT, MD.	NATIONAL HYDROELECTRIC POWER
MONTANA COLL, OF MINERAL SCIENCE	GODDARD SPACE FLIGHT CENTER.	CORP. LTD., NEW DELHI (INDIA). Updating and Refurbishing Hydro Plants in
AND TECHNOLOGY, BUTTE. DEPT. OF METALLURGICAL AND MINERAL	Snow Cover Record in Eurasia, W89-02612 2C	India,
PROCESSING ENGINEERING. Pilot Scale Results of Metal Value Recovery	Influence of Snow Structure Variability on	W89-03155 8C
from Mixed Metal Hydroxide Sludges,	Global Snow Depth Measurement using Micro-	NATIONAL INST. FOR ENVIRONMENTAL
W89-02394 5D	wave Radiometry, W89-02620 7B	STUDIES, TSUKUBA (JAPAN). ENVIRONMENTAL BIOLOGY DIV.
MONTANA STATE UNIV., BOZEMAN. DEPT. OF CIVIL ENGINEERING.	Nimbus-7 SMMR Snow Cover Data,	Chronic Effects of Cu on Reproduction of Poly-
Effects of Geology, Runoff, and Land Use on the Stability of the West Gallatin River System,	W89-02622 7C	pedilum nubifer (Chironomidae) through Water and Food,
Gallatin County, Montana, W89-02472 4C	NATIONAL BOARD OF WATERS, HELSINKI (FINLAND).	W89-03296 5C
MONTANA UNIV., POLSON, FLATHEAD	Treatment of Groundwater with Slow Sand Fil-	NATIONAL INST. FOR MINAMATA
LAKE BIOLOGICAL STATION. Hyporheic Habitat of River Ecosystems,	tration, W89-03090 5F	DISEASE, MINAMATA (JAPAN). DEPT. OF BASIC MEDICAL SCIENCE.
W89-03122 2E	NATIONAL CENTER FOR ATMOSPHERIC RESEARCH, BOULDER, CO.	Volatilization of Mercury Compounds by Meth ylmercury-Volatilizing Bacteria in Minamata Bay Sediment,
MOREHOUSE SCHOOL OF MEDICINE, ATLANTA, GA. DEPT. OF COMMUNITY HEALTH/PREVENTIVE MEDICINE.	Rising Level of the Great Salt Lake: Impacts and Adjustments.	W89-03197 5I
Sewage Hardness and Mortality from Cancer	W89-03127 6F	NATIONAL INST. FOR WATER RESEARCH,
and Cardiovascular Disease, W89-03309 5D	NATIONAL CHENG KUNG UNIV., TAINAN (TAIWAN).	PRETORIA (SOUTH AFRICA). Monitoring and Surveillance,
MORWIJK ENTERPRISES, VANCOUVER	Anaerobic Fluidized Bed Treatment of an Indus-	W89-02991 71
(BRITISH COLUMBIA). Migration of Acidic Groundwater Seepage from	trial Wastewater, W89-03162 5D	
Uranium-Tailings Impoundments: 1. Field Study		PANAJI (INDIA). CHEMICAL OCEANOGRAPHY DIV.
and Conceptual Hydrogeochemical Model, W89-03037 5E		DDT Residues in Sediments from the Bay of
Migration of Acidic Groundwater Seepage from	Biodegradation of Recalcitrant Industria	Bengal, W89-03198 5.
Uranium-Tailings Impoundments: 2. Geochemi- cal Behavior of Radionuclides in Groundwater		
W89-03038 5E		NATIONAL MARINE FISHERIES SERVICE, CHARLESTON, SC. CHARLESTON LAB.
Migration of Acidic Groundwater Seepage from	NATIONAL ENVIRONMENTAL ENGINEERING RESEARCH INST., NAGPUR	Distribution Pattern and Reduction of Polychlo
Uranium-Tailings Impoundments: 3. Simulation of the Conceptual Model with Application to	(INDIA), ENVIRONMENTAL	rinated Biphenyls (PCB) in Bluefish Pomatomu saltatrix (Linnaeus) Fillets through Adipo-
Seepage Area A, W89-03039 51	Biological Treatment of Toxic Industrial Waste W89-02919 5D	
		7 77 03 03 137

5B

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WA. NORTHWEST AND ALASKA	NATIONAL SWEDISH ENVIRONMENT PROTECTION BOARD, SOLNA, TRACE	NAVAL POSTGRADUATE SCHOOL, MONTEREY, CA.
FISHERIES CENTER. Copper Intoxication in Chinook Salmon (Oncor-	METAL LAB. Effects of Liming on the Distribution of Cadmi-	Tropical and Monsoonal Studies, W89-02968 2B
hynchus Tshawystscha) Induced by Natural Springwater: Effects on Gill Na(+), K(+)-	um in Water, Sediment, and Organisms in a Swedish Lake,	NEBRASKA UNIVLINCOLN, DEPT. OF
ATPase, and Plasma Glucose,	W89-03224 5B	CIVIL ENGINEERING.
W89-03228 5C	NATIONAL TECHNICAL INFORMATION	Kinetics of Low Solids Bio-denitrification of Water Supplies,
NATIONAL OCEANIC AND ATMOSPHERIC	SERVICE, SPRINGFIELD, VA. Desalination of Water. Citations from the COM-	W89-03166 5F
ADMINISTRATION, ANN ARBOR, MI.	PENDEX Engineering Information, Inc. Data-	4
GREAT LAKES ENVIRONMENTAL RESEARCH LAB.	base (Dec 83 - Sep 87).	NEBRASKA UNIV., LINCOLN, DEPT. OF GEOGRAPHY.
Total Phosphorus Budget for Lake St. Clair:	W89-02782 3A	Relationship Between Snow Cover and Atmos-
1975-80,	Dredging: Technology and Environmental As-	pheric Thermal and Circulation Anomalies,
W89-03168 5B	pects. Citations from the Life Sciences Collec- tion Database (Jan 78 - Aug 87).	W89-02608 2C
Historical Basis for Limits on Lake Superior Water Level Regulations,	W89-02783 2J	NEBRASKA UNIVLINCOLN. SCHOOL OF
W89-03173 4A	Acid Precipitation. Citations from the COM-	BIOLOGICAL SCIENCES. Diversity of the Parasite Assemblage of Fundu-
	PENDEX Engineering Information Inc. Data-	lus zebrinus in the Platte River of Nebraska,
New Biological Marker Layer in the Sediments	base (Sept 84 - Aug 86).	W89-03062 2H
of the Great Lakes: Bythothrephes cederstroemi (Schodler) Spines,	W89-02784 5B	
W89-03178 2H	Acid Precipitation. Citations from the COM-	NEW JERSEY DEPT. OF ENVIRONMENTAL PROTECTION, TRENTON. RESIDUALS
	PENDEX Engineering Information Inc. Data-	MANAGEMENT SECTION.
Operations for an Under-Ice Ecology Program,	base (Sept 86 - Aug 87). W89-02785 5B	Regulation of the Agricultural Utilization of
W89-03179 2H	W89-02785 5B	Sewage Sludge in New Jersey,
Utility of Soluble Reactive Phosphorus Meas-	Wastewater Treatment: Ozonation Processes	W89-02676 5E
urements in Great Lakes Surveillance Programs:	and Equipment. Citations from the Selected	NEW JERSEY INST. OF TECH., NEWARK.
A Summary,	Water Resources Abstracts Database (Jan 77 - Aug 87).	DEPT. OF CIVIL AND ENVIRONMENTAL
W89-03180 5A	W89-02786 5D	ENGINEERING.
Dynamics of Lake Michigan Phytoplankton: Re-		Assessment of the Degree of Treatment Re-
lationship to Nitrogen and Silica Fluxes,	NATIONAL TECHNICAL UNIV., ATHENS	quired for Toxic Wastewater Effluents, W89-02303 5D
W89-03230 2H	(GREECE). DEPT. OF CIVIL ENGINEERING. Stochastic Modelling of Rainfall Occurrences in	W 07-02303
NAME OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OWNER OWNER.	Continuous Time,	NEW MEXICO BUREAU OF MINES AND
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, PRINCETON, NJ.	W89-03049 2B	MINERAL RESOURCES, SOCORRO.
GEOPHYSICAL FLUID DYNAMICS LAB.	NATIONAL WATER RESEARCH INST.,	Recovery of Moisture/Solute Profiles in Re- claimed Coal-Mine Spoil, Northwest New
Characteristics of Seasonal Snow Cover as Sim-	BURLINGTON (ONTARIO).	Mexico.
ulated by GFDL Climate Models,	Interstitial Water Quality of Lake Trout Spawn-	W89-02360 2F
W89-02628 2C	ing Habitat,	
Influence of Potential Evaporation on the Varia-	W89-03172 5C	NEW MEXICO INST. OF MINING AND
bilities of Simulated Soil Wetness and Climate,	NATIONAL WATER RESEARCH INST.,	TECHNOLOGY, SOCORRO. DEPT. OF GEOSCIENCE.
W89-03308 2D	BURLINGTON (ONTARIO),	Modeling the Response of Lake-Aquifer Sys-
NATIONAL OCEANIC AND ATMOSPHERIC	ENVIRONMENTAL CONTAMINANTS DIV. Photodegradation of the Lampricide 3-Trifluor-	tems to Acid Precipitation,
ADMINISTRATION, ROCKVILLE, MD. AIR	omethyl-4-nitrophenol (TFM): 2. Field Confir-	W89-02341 5C
RESOURCES LABS.	mation of Direct Photolysis and Persistence of	Field Simulation of Waste Impoundment Seep-
Fiscal Year 1985 Summary Report of NOAA		age in the Vadose Zone,
Meteorology Division Support to the Environ- mental Protection Agency.	Treatment, W89-03175 5B	W89-02348 5B
W89-02857 5E		
	NATIONAL WATER RESEARCH INST.,	Field Study of Ephemeral Stream-Aquifer Inter- action.
NATIONAL OCEANIC AND ATMOSPHERIC	BURLINGTON (ONTARIO), RIVERS RESEARCH BRANCH,	W89-02349 2F
ADMINISTRATION, ROCKVILLE, MD. OCEAN ASSESSMENTS DIV.	Relationships Among Secchi Disk Depth, Beam	
Monitoring, Research, and Management: Inte	Attenuation Coefficient, and Irradiance Attenu-	NEW MEXICO SOLAR ENERGY INST., LAS
gration for Decisionmaking in Coastal Marine	ation Coefficient for Great Lakes Waters, W89-03176 2H	CRUCES. Use of Saline Water for Buffalo Gourd Produc-
Environments,		tion in New Mexico.
W89-02323 5A	NATIONAL WATER SUPPLY AND	W89-02475 3C
NATIONAL OCEANIC AND ATMOSPHERIC	DRAINAGE BOARD, COLOMBO (SRI	A THE RESIDENCE OF THE PARTY OF
ADMINISTRATION, SEATTLE, WA. PACIFIC	LANKA). Development of Groundwater Resources in Sri	NEW MEXICO STATE ENGINEER OFFICE, SANTA FE.
MARINE ENVIRONMENTAL LAB.	Lanka,	Use of a Regional Ground-Water Flow Model
Formulas for Velocity, Sediment Concentration and Suspended Sediment Flux for Steady Uni		for Water Rights Administration in a Southwest
Directional Pressure-Driven Flow,	NAVAL AIR REWORK FACILITY, CHERRY	Alluvial Basin,
W89-02779 2	POINT, NC.	W89-02332 4B
NATIONAL PUBLIC HEALTH INST	Calpurnia and the Strip Barn,	NEW MEXICO STATE UNIV., LAS CRUCES.
KUOPIO (FINLAND), DEPT. OF	W89-02411 5D	DEPT. OF CROP AND SOIL SCIENCES.
ENVIRONMENTAL HYGIENE AND	NAVAL OCEAN SYSTEMS CENTER, SAN	Predicting Chemical Movement in Soils,
TOXICOLOGY.	DIEGO, CA.	W89-02473 5B
In Vitro Genotoxicity of Chlorinated Drinkin Water Processed from Humus-Rich Surface		
Water Processed from Humus-Rich Surface Water,	e sessment of Organotin Leachates. Test and Eval- uation,	Modeling Acid Migration Through Soils,
W89-03202 5		

NEW MEXICO UNIV., ALBUQUERQUE. BUREAU OF BUSINESS AND ECONOMIC RESEARCH.

NEW MEXICO UNIV., ALBUQUERQUE. BUREAU OF BUSINESS AND ECONOMIC	NORSK INST. FOR VANNFORSKNING, OSLO.	Consideration of Dimensional Dependence in Modelling the Structure of Flow Zones within
Projections of Water Availability in the Lower	Reversibility of Acidification Shown by Whole- Catchment Experiments,	the Subsurface, W89-02551 5B
Rio Grande, Gila-San Francisco and Mimbres Drainage Basins to 2005,	W89-03120 5B	OAK RIDGE NATIONAL LAB., TN.
W89-02474 6D	NORTH CAROLINA UNIV., CHAPEL HILL.	ANALYTICAL CHEMISTRY DIV.
NEW MEXICO UNIV., ALBUQUERQUE. DEPT. OF CIVIL ENGINEERING.	DEPT. OF ENVIRONMENTAL SCIENCES AND ENGINEERING.	Application of XAD-4 Solid Sorbent and HPLC with Electrochemical Detection to the Analysis
Ephemeral Runoff and Groundwater Recharge, W89-02350 2F	Comparison of Anodic Stripping Voltammetry Speciation Data with Empirical Model Predic- tions of pCu,	of Phenols in Water, W89-02420 5A
P 11 P 1 1 N 11 11 11 11	W89-02646 7B	
Permeable Barriers: A New Alternative for Treatment of Contaminated Ground Waters,	NORTH CAROLINA UNIV. MODELIEAD	OAK RIDGE NATIONAL LAB., TN. ENVIRONMENTAL SCIENCES DIV.
W89-02355 5G	NORTH CAROLINA UNIV., MOREHEAD CITY. INST. OF MARINE SCIENCES. Effects of the Blue-Green Alga Microcystis Aer-	Discussion of the Changes in Soil Acidity Due to Natural Processes and Acid Deposition,
NEW YORK STATE DEPT. OF HEALTH, ALBANY, WADSWORTH CENTER FOR	uginosa on Zooplankton Competitive Relations, W89-03118 2H	W89-02307 5B
LABS. AND RESEARCH. Asbestos-Contaminated Drinking Water: Its	Nuisance Phytoplankton Blooms in Coastal, Es-	Lagrangian-Eulerian Approach to Modeling Hydrogeochemical Transport of Multi-Compo-
Impact on Household Air, W89-03299 5B	tuarine, and Inland Waters, W89-03262 2H	nent Systems,
NEW YORK STATE WATER RESOURCES		W89-03320 5B
RESEARCH INST., ITHACA. Fiscal Year 1986 Program Report (New York	NORTH CAROLINA WATER RESOURCES RESEARCH INST., RALEIGH.	OFFICE OF TECHNOLOGY ASSESSMENT,
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W89-02471 9D	na Water Resources Research Institute). W89-02554 9D	Treatment. W89-02849 3A
NEWCASTLE UPON TYNE UNIV.	NORTH DAKOTA UNIV., GRAND FORKS.	W 69-02649
(ENGLAND), DEPT, OF CIVIL ENGINEERING.	SCHOOL OF MEDICINE.	OHIO STATE UNIV., COLUMBUS.
Fate of COD in an Anaerobic System Treating	You and Your Drinking Water: Health Implica-	ENVIRONMENTAL BIOLOGY PROGRAM.
High Sulphate Bearing Wastewater, W89-02295 5D	tions for the Use of Cation Exchange Water Softeners, W89-03060 5F	Role of the Seed Bank in the Development of Vegetation on a Freshwater Marsh Created
Bed Load Discharge Equations for Steep Moun-	W 85-03000	from Dredge Spoil, W89-03169 2H
tain Rivers,	NORTH-EASTERN HILL UNIV., SHILLONG	W 07-03107
W89-02445 2J	(INDIA). DEPT. OF BOTANY. Effect of Assam Crude on Photosynthesis and	OK TEDI MINING LTD., PORT MORESBY
NIEDERSAECHSISCHES LANDESAMT FUER	Associated Electron Transport System in Ana-	(PAPUA NEW GUINEA).
BODENFORSCHUNG, HANOVER (GERMANY, F.R.)	baena doliolum, W89-03207 5C	Estimating the Transport and Deposition of Mining Waste at Ok Tedi,
Computer Modelling of Confined Aquifer Sys-		W89-02461 2J
tems for Interpretation of Chemical and Envi- ronmental Isotope Data,	NORTH PENN WATER AUTHORITY, LANSDALE, PA.	OKLAHOMA STATE UNIV., STILLWATER.
W89-03015 2F	Control of Volatile Organic Contaminants in	Soil Testing As a Guide to Prudent Use of Nitrogen Fertilizers in Oklahoma Agriculture,
NIXDORF COMPUTER OY A.B., VANTAA	Groundwater by In-Well Aeration, W89-02955 5F	W89-02664 7B
(FINLAND),		
Chemical-Biological Treatment versus Chemical Treatment: A Case Study,	NORTH TEXAS STATE UNIV., DENTON.	OKLAHOMA STATE UNIV., STILLWATER.
W89-02814 5D	INST. OF APPLIED SCIENCES. Ground Water Contamination from Saltwater	DEPT. OF AGRICULTURAL ECONOMICS. Ground Water Conservation Techniques: Poten-
NORGES TEKNISKE HOEGSKOLE,	Intrusion And Limitations on Agricultural Ac- tivities,	tial Impacts on Water Usage and Quality, W89-02658 3F
TRONDHEIM. Coagulation as the First Step in Wastewater	W89-02662 5B	W89-02038 3F
Treatment,	NORTHROP SERVICES, INC., CORVALLIS,	Economic And Environmental Impacts of Using
W89-02811 5D	OR. Ohio Stream Regionalization Project: A Com-	Municipal Sewage Effluent for Agricultural Production,
NORGES TEKNISKE HOEGSKOLE, TRONDHEIM, SELSKAPET FOR	pendium of Results,	W89-02663 5E
INDUSTRIELL OG TEKNISK FORSKNING.	W89-02932 2H	OKLAHOMA STATE UNIV., STILLWATER.
Treatment of Oil and Oily Wastes, W89-02963 5G	Correspondence Between Ecoregions and Spa- tial Patterns in Stream Ecosystems in Oregon,	DEPT. OF AGRONOMY. Efficient Nitrogen Fertilization in Agricultural
Oil Spill Combat in the Arctic - An Alternative	W89-03223 2H	Production Systems,
Approach, W89-02966 5G	NORTHWEST HYDRAULIC CONSULTANTS	W89-02665 5B
	LTD., EDMONTON (ALBERTA). Sediment Balance Considerations Linking Long-	Interactive Simulation of Chemical Movement in Soil,
NORSK INST. FOR LUFTFORSKNING, LILLESTROEM.	Term Transport and Channel Processes, W89-02438	W89-02675 5B
Acid Precipitation Literature Review 1986: Emission, Transport, Transformation and Depo-	11 07 02430 23	OKLAHOMA UNIV., NORMAN. DEPT. OF
sition of Acidic Trace Species, W89-02822 5B	NORTHWEST HYDRAULIC CONSULTANTS LTD., NORTH VANCOUVER (BRITISH	CIVIL ENGINEERING AND ENVIRONMENTAL SCIENCE,
Review of Papers Published in 1985 about Emis-	COLUMBIA). River Bed Scour and Construction of Stone	Effects of Irrigation Practices on Stream-Con-
sion, Transport, Transformation and Deposition of Atmospheric Trace Constituents of Impor-	Riprap Protection, W89-02442 8A	nected Phreatic Aquifer Systems, W89-02661 3F
tance for Acid Deposition,		OKLAHOMA UNIV., NORMAN, DEPT, OF
W89-02827 5B	NOTRE DAME UNIV., IN. DEPT. OF CIVIL ENGINEERING.	ZOOLOGY,
NORSK INST. FOR SKOGFORSKNING, AAS.	Development of Estimation Methods for Tribu-	Photosynthetic Carbon Metabolism by Phyto-
Air Pollution and Soil Acidification, W89-02306 5B	tary Loading Rates of Toxic Chemicals,	plankton in a Nitrogen-Limited Reservoir,
	W89-02547 5B	W89-03215 2H

QUEEN MARY COLL, LONDON (ENGLAND).

OKLAHOMA UNIV., NORMAN. ENVIRONMENTAL AND GROUND WATER	OTTAWA UNIV. (ONTARIO), DEPT. OF BIOLOGY.	POLISH ACADEMY OF SCIENCES, KRAKOW. INST. OF GEOGRAPHY AND
INST. Nitrates and Pesticides in Ground Water: An	Fertility and Disturbance Gradients: A Summa- ry Model for Riverine Marsh Vegetation,	SPATIAL ORGANIZATION. Water and Sediment Dynamics of the Homerka
Analysis of a Computer-Based Literature Search,	W89-03294 2H	Catchment,
W89-02666 5B	OXFORD POLYTECHNIC (ENGLAND). DEPT.	W89-02895 2J
National Assessment of Ground Water Contami- nation from Pesticides and Fertilizers,	OF GEOGRAPHY. Microerosion Processes and Sediment Mobiliza- tion in a Roadbank Gully Catchment in Central	POLISH ACADEMY OF SCIENCES, WARSAW. INST. OF GEOPHYSICS.
W89-02673 5B	Oklahoma,	Hydrological Sciences in Perspective,
OKLAHOMA WATER RESOURCES BOARD,	W89-02894 2J	W89-02718 2A
OKLAHOMA CITY.	OXFORD UNIV. (ENGLAND), DEPT. OF	Mathematical Modelling,
Ground Water Recharge for Oklahoma: An Analysis of Past and Future Methodology,	GEOGRAPHY.	W89-02725 2A
W89-02660 4B	Stable Isotopes: An Investigation into Their Ap- plication in Karst Hydrology in the U.K., with	
Investigation of Nitrate Contamination in Shal-	Special Reference to the Malham Area, North	PRC ENGINEERING INTERNATIONAL, ENGLEWOOD, CO.
low Ground Waters Near Woodward, Oklaho-	Yorkshire,	Vibration and Leakage of Weir Gates,
ma, W89-02671 5B	W89-02734 2F	W89-03073 8C
	PACIFIC ENVIRONMENTAL GROUP, INC.,	PRINCIPAL INTEL AL PERE OF CHILL
OLD DOMINION UNIV. RESEARCH FOUNDATION, NORFOLK, VA. SPREX Hydrographic Data Report, Volume 3	SANTA CLARA, CA. Role of Aquifer Testing in Design of Constant-	PRINCETON UNIV., NJ. DEPT. OF CIVIL ENGINEERING AND OPERATIONS RESEARCH.
- Chlorophyll and Nutrients, W89-03323 2L	Head Extraction Systems, W89-02346 7B	Model Calibration Based on Random Environ- mental Fluctuations,
ONTARIO MINISTRY OF THE	PACIFIC SOUTHWEST FOREST AND RANGE	W89-03105 7A
ONTARIO MINISTRY OF THE ENVIRONMENT, TORONTO. Probability and Stochastic Modelling of Water	EXPERIMENT STATION, ARCATA, CA. Monitoring Baseline Suspended Sediment in	PROCESS APPLICATIONS, INC., FORT
Quality Parameters in the Thames River, W89-03135 5B	Forested Basins: The Effects of Sampling on Suspended Sediment Rating Curves,	COLLINS, CO. Handbook: Improving POTW Performance
OREGON STATE UNIV., CORVALLIS.	W89-03053 2J	Using the Composite Correction Program Approach,
Conceptual Models of Sediment Transport in Streams,	PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY, LAHORE.	W89-02845 5D
W89-02443 2J	PakistanStatus Report, W89-02381 4B	PURDUE UNIV., LAFAYETTE, IN. DEPT. OF
OREGON STATE UNIV., CORVALLIS. CLIMATIC RESEARCH INST.	PENNSYLVANIA STATE UNIV., UNIVERSITY	BIOLOGICAL SCIENCES. Effects of Heavy Metal Pollution on Epilithic
CO2-Induced Changes in Seasonal Snow Cover	PARK, DEPT. OF AGRICULTURAL	Bacteria, W89-02552 5C
Simulated by the OSU Coupled Atmospheric- Ocean General Circulation Model,	ENGINEERING. Ground Water and Agriculture: Addressing the	W89-02552 5C
W89-02629 2C	Information Needs of Pennsylvania's Chesa-	PURDUE UNIV., LAFAYETTE, IN. DEPT. OF
OREGON STATE UNIV., CORVALLIS. COLL. OF FORESTRY.	peake Bay Program, W89-02680 5G	HORTICULTURE. Wastewater Irrigation of Vegetable Crops,
Review of the Crater Lake Limnological Pro-	PENNSYLVANIA STATE UNIV., UNIVERSITY	W89-03282 5E
grams, W89-02322 2H	PARK. INST. FOR RESEARCH ON LAND AND WATER RESOURCES.	PURDUE UNIV., LAFAYETTE, IN. SCHOOL OF CIVIL ENGINEERING.
OREGON STATE UNIV., CORVALLIS. COLL. OF OCEANOGRAPHY.	Synoptic-Scale Assessment of Surface Runoff, W89-02703 2E	Respiration-Based Evaluation of Nitrification Inhibition Using Enriched Nitrosomonas Cultures,
Cycling of Methane, Carbon Monoxide, Nitrous	PENNSYLVANIA UNIV., PHILADELPHIA.	W89-02302 7B
Oxide, and Hydroxylamine in a Meromictic, Coastal Lagoon,	DEPT. OF CIVIL ENGINEERING.	
W89-03191 2L	Anoxic/Oxic Activated Sludge Treatment of Cyanogens and Ammonia in the Presence of	PURDUE UNIV., LAFAYETTE, IN. WATER RESOURCES RESEARCH CENTER.
OREGON STATE UNIV., CORVALLIS. DEPT.	Phenols, W89-02298 5D	Agricultural Impact on Groundwater Quality,
OF ATMOSPHERIC SCIENCES, Oklahoma-Kansas Mesoscale Convective	W 89-02298	W89-02549 5B
System of 10-11 June 1985: Precipitation Struc- ture and Single-Doppler Radar Analysis,	PIRNIE (MALCOLM), INC., PARAMUS, NJ. Technologies and Costs for the Treatment of	QUEBEC UNIV., RIMOUSKI. DEPT. OF OCEANOGRAPHY.
W89-03273 2B	Microbial Contaminants in Potable Water Sup- plies.	Physical Oceanography of the St. Lawrence Es-
OSAKA CITY UNIV. (JAPAN). DEPT. OF PHYSICS.	W89-02412 5F	tuary, W89-02698 2L
Precise Measurement of Microforms and Fabric	PIRNIE (MALCOLM), INC., PHOENIX, AZ.	
of Alluvial Cones for Prediction of Landform Evolution.	Recognizing Petroleum Hydrocarbon Contami-	QUEBEC UNIV., SAINTE-FOY.
W89-02908 2J	nation in the Vadose Zone with Photoionization Detection Scanning of Field Samples,	Partitioning of Trace Metals in Sediments, W89-02649 5B
OSAKA PREFECTURAL UNIV., SAKAI	W89-02351 5A	OUEDN ELIZABETH COLL LONDON
(JAPAN). LAB. OF ENVIRONMENTAL CHEMISTRY.	PLYMOUTH POLYTECHNIC (ENGLAND). DEPT. OF GEOGRAPHICAL SCIENCES.	QUEEN ELIZABETH COLL., LONDON (ENGLAND).
Continuous Flow Determination of Carbon Di- oxide in Water by Membrane Separation-Chemi-	Hydrochemical Characteristics of a Dartmoor	Analysis of Bank Stability in the DEC Water- sheds, Mississippi,
luminescent Detection, W89-03182 7B	Hillslope, W89-02903 2E	W90,02925 AT
OSLO UNIV. (NORWAY), INST. OF GEOPHYSICS.	PLYMOUTH POLYTECHNIC (ENGLAND). INST. OF MARINE STUDIES.	QUEEN MARY COLL., LONDON (ENGLAND).
Hydrology and Data Acquisition, W89-02726 2A	Tidally Generated Estuarine Mixing Processes, W89-02686 2L	Sediment Transport in Gravel-Bed Rivers. W89-02430 21

QUEEN MARY COLL, LONDON (ENGLAND). DEPT. OF CIVIL ENGINEERING.

QUEEN MARY COLL., LONDON (ENGLAND), DEPT, OF CIVIL	RIJKS GEOLOGISCHE DIENST, HAARLEM (NETHERLANDS).	SAINT DAVID'S UNIV. COLL., LAMPETER (WALES), DEPT. OF GEOGRAPHY.
ENGINEERING.	Hydrogeological Mapping in Coastal Areas,	Chemical Erosion in Tower Karst Terrain,
Mathematical Hydraulic Model of the River	W89-02390 2F	Kinta Valley, Peninsular Malaysia,
Nene a Canalized, and Heavily Controlled	DITUONSTITUT VOOR DE	W89-02738 2J
River, W89-03141 4A	RIJKSINSTITUUT VOOR DE VOLKSGEZONDHEID EN MILIEUHYGIENE,	CAN DECO CEATE INDI CA DEPE OF
W 69-03141	BILTHOVEN (NETHERLANDS). LAB. FOR	SAN DIEGO STATE UNIV., CA. DEPT. OF CIVIL ENGINEERING.
QUEEN MARY COLL., LONDON	SOIL AND GROUNDWATER.	Modelling Fluvial Processes in Streams with
(ENGLAND). SCHOOL OF BIOLOGICAL	Groundwater Hydrology,	Gravel Mining,
SCIENCES.	W89-02720 2F	W89-02462 2E
Interactions of Sphagnum with Water and Air,	RIJKSINSTITUUT VOOR NATUURBEHEER,	
W89-02312 2H	TEXEL (NETHERLANDS).	SAVANNAH RIVER ECOLOGY LAB., AIKEN,
RADIAN CORP., AUSTIN, TX.	Flora and Macrofauna of Intertidal Sediments,	SC.
Installation Restoration Program Phase II - Con-	W89-02763 2L	Hydrochory and Regeneration in a Bald Cy- press-Water Tupelo Swamp Forest,
firmation/Quantification. Stage I.	DI WORD OF THE PROPERTY OF THE	W89-03295 2H
W89-02999 5B	RIJKSINSTITUUT VOOR ZUIVERING VAN AFVALWATER, LELYSTAD	
RADIAN CORP., MILWAUKEE, WI.	(NETHERLANDS).	SCARBOROUGH COLL., WESTHILL
Evaluation of Biological Treatment of Pharma-	Clean Technology in the Netherlands: The Role	(ONTARIO). DEPT. OF GEOGRAPHY.
ceutical Wastewater with PAC Addition.	of the Government,	Runoff and Sediment Transport Dynamics in
Volume I,	W89-02801 5G	Canadian Badland Micro-Catchments,
W89-02948 5D	RJN ENVIRONMENTAL ASSOCIATES, INC.,	W89-02887 2E
Evaluation of Biological Treatment of Pharma-	COLLEGE PARK, MD.	SCHREUDER AND DAVIS, INC., TAMPA, FL.
ceutical Wastewater with PAC Addition.	Use of Remote Gauging to Measure Sewer	Simulating Underground Mines in a Regional
Volume II - Appendices,	Invert Elevations and Head Loss,	Model,
W89-02949 5D	W89-03280 5D	W89-02339 4C
READING UNIV. (ENGLAND). DEPT. OF	ROCHESTER UNIV., NY. INST. OF OPTICS.	SCIENCE APPLICATIONS, INC., OAK
SOIL SCIENCE. Floodplain Response of a Small Tropical	Groundwater Flow in the Lowland Limestone Aquifer of Eastern Co. Galway and Eastern Co.	RIDGE, TN.
Stream,	Mayo, Western Ireland,	Chlorine Sensitivity of Early Life Stages of
W89-02885 2E	W89-02736 2F	Freshwater Fish, W89-03333 5C
		W 89-03333
RESEARCH AND DESIGN INST. OF PUBLIC	ROSENSTIEL SCHOOL OF MARINE AND	SCIENTIFIC CONTROL LABS., INC.,
WORKS AND UTILITIES, SOFIA	ATMOSPHERIC SCIENCE, MIAMI, FL.	CHICAGO, IL.
(BULGARIA). Biotechnology for Manganese Removal from	Observation of Stratiform Rain with 94 GHz and S-Band Doppler Radar,	Performance of Analytical Test Kits on Metal
Groundwater,	W89-02830 2B	Finishing Wastewater Samples,
W89-03093 5F	110702030	W89-02403 5D
	ROSENSTIEL SCHOOL OF MARINE AND	COS ENGINEEROS ING. COMPLOTON PU
RESEARCH TRIANGLE INST., RESEARCH	ATMOSPHERIC SCIENCE, MIAMI, FL. DIV.	SCS ENGINEERS, INC., COVINGTON, KY.
TRIANGLE PARK, NC.	OF APPLIED MARINE PHYSICS.	Pilot Scale Evaluation of Sludge Landfilling: Four Years of Operation,
U.S. Production of Manufactured Gases: Assessment of Past Disposal Practices,	Dispersion in Shallow Estuaries, W89-02685 2L	W89-02978 5E
W89-02964 5E	W 57-02083	
	ROYAL HOLLOWAY AND BEDFORD NEW	SENTER FOR INDUSTRIFORSKNING, OSLO
RESTECH HOUSTON, INC., TX.	COLL., EGHAM (ENGLAND).	(NORWAY).
Improved Fresh Water Assessment in Sand	Pesticide Impact on Stream Fauna with Special	Critique of Models for Freshwater and Soil
Aquifers Utilizing Geophysical Well Logs, W89-02347 2F	Reference to Macroinvertebrates,	Acidification,
W 09-02347	W89-02773 5C	W89-02967 5B
RHODE ISLAND UNIV., NARRAGANSETT.	ROYAL INST. OF TECH., STOCKHOLM	SHAUGHNESSY HOSPITAL, VANCOUVER
GRADUATE SCHOOL OF OCEANOGRAPHY.	(SWEDEN). DEPT. OF CHEMICAL	(BRITISH COLUMBIA), DIV, OF
Physical Energy Inputs and the Comparative	ENGINEERING.	MICROBIOLOGY,
Ecology of Lake and Marine Ecosystems,	Solute Transport in Fractured Rocks,	Temporal Relationship of Vibrio parahaemolyti-
W89-03272 2A	W89-03014 2F	cus in Patients and the Environment,
RHODES UNIV., GRAHAMSTOWN (SOUTH	ROYAL SOCIETY FOR THE PROTECTION	W89-03064 5E
AFRICA), DEPT. OF GEOGRAPHY.	OF BIRDS, SHOREHAM-BY-SEA (ENGLAND).	SHAW MONT NEWFOUNDLAND LTD., ST.
River Conservation - Implications for Legisla-	Birds,	JOHN'S.
tion,	W89-02772 2L	Canal Design by an Armouring Process,
W89-02992 6E	ROYCE PROCESS EQUIPMENT CO., INC.,	W89-02441 8A
RHODES UNIV., GRAHAMSTOWN (SOUTH	PEARLAND, TX.	
AFRICA). INST. OF FRESHWATER STUDIES.	Treatment of Process Wastewater from Petro-	SHEFFIELD UNIV. (ENGLAND), DEPT. OF
Conservation Aims, Criteria, and Goals for	chemical Plant Using a Rotating Biological Con-	BOTANY.
Rivers,	tactor - A Case Study,	Acidification and Succession in a Flood-Plain
W89-02987 2H	W89-02292 5D	Mire in the Norfolk Broadland, U.K., W89-03123
RICE UNIV., HOUSTON, TX, DEPT. OF	DIFFCEDS THE STATE VALUE NEW	W 69-03123
ENVIRONMENTAL SCIENCE AND	RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. DEPT. OF CHEMICAL	SHEFFIELD UNIV. (ENGLAND), DEPT. OF
ENGINEERING.	AND BIOCHEMICAL ENGINEERING.	GEOGRAPHY.
Biodegradation Modeling at Aviation Fuel Spill		Limestone Weathering Under a Soil Cover an
Site,	tion of 1,1,1-Trichloroethane,	the Evolution of Limestone Pavements, Malhar
W89-03100 5G	W89-03164 5D	
RIDER COLL, LAWRENCEVILLE, NJ. DEPT.	SAINT ANDREWS UNIV. (SCOTLAND).	W89-02740 2
OF GEOSCIENCES.	DEPT. OF GEOGRAPHY.	Hydrology and Solute Uptake in Hillslope Soil
Sediment Transport from Delaware Bay to the		
New Jersey Inner Shelf,	Scotland,	Project,
W89-03187 2J	W89-02912 2E	W89-02891 20

TECHNICAL UNIV. OF DENMARK, LYNGBY. DEPT. OF SANITARY ENGINEERING.

SIMONS AND ASSOCIATES, INC., FORT COLLINS, CO.	SOUTHAMPTON GENERAL HOSPITAL (ENGLAND).	Comparative Ecology of the Macrofauna of Freshwater and Marine Muds,
Differences Between Gravel- and Sand-bed Rivers,	Appendicitis Epidemic Following Introduction of Piped Water to Anglesey,	W89-03268 2H
W89-02431 2J	W89-03041 5F	STATE UNIV. OF NEW YORK, SYRACUSE.
SIMONS, LI AND ASSOCIATES, INC., FORT	SOUTHAMPTON UNIV. (ENGLAND). DEPT.	COLL, OF ENVIRONMENTAL SCIENCE AND FORESTRY.
COLLINS, CO. Investigation of Sediment Routing by Size Frac-	OF GEOGRAPHY. Influence of Vegetation on Stream Channel	Effects of Simulated Acid Rain on Sugar Maple
tions in a Gravel-Bed River, W89-02444 2J	Processes, W89-02911 2J	Seedling Root Growth, W89-03300 5C
SKIDAWAY INST. OF OCEANOGRAPHY,		STATIUNEA DE CERCETARI STEJARUL,
SAVANNAH, GA. Nearshore Transport Processes Affecting the	SOUTHEASTERN FOREST EXPERIMENT STATION, ASHEVILLE, NC. COWEETA	PIATRA-NEAMT (ROMANIA).
Dilution and Fate of Energy-Related Contami-	HYDROLOGIC LAB. Dynamics of Water Chemistry in Hardwood and	GEOMORPHOLOGY LAB. Landsliding, Slope Development and Sediment
nants, W89-02843 5B	Pine Ecosystems,	Yield in a Temperate Environment: Northeast
Nearshore Transport Processes Affecting the	W89-02900 2K	Romania, W89-02897 2J
Dilution and Fate of Energy-Related Contami-	SOUTHERN PLAINS RANGE RESEARCH STATION, WOODWARD, OK.	
nants, W89-02972 5B	Saline Seep on Wheatland in Northwest Oklaho-	STRASBOURG-1 UNIV. (FRANCE). INST. DE GEOGRAPHIE.
Trace Metal Transport in a Tropical Estuary,	ma, W89-02672 5B	Spatial Variability of Soil Hydrodynamic Prop- erties in the Petite Fecht Catchment, Soultzeren,
W89-03276 2L	CRACE COMMAND RETERION AND CO	France - Preliminary Results,
SLOVENSKA AKADEMIA VIED,	SPACE COMMAND, PETERSON AFB, CO. Sequestration of Iron in Groundwater by Poly-	W89-02883 2G
BRATISLAVA (CZECHOSLOVAKIA). USTAV HYDROLOGIE A HYDRAULIKY.	phosphates, W89-03109 5F	SUISELECTRA
Hydrology versus Water Resources Manage-		INGENIEURUNTERNEHMUNG A.G., BASEL. New Lebring Scheme Replaces the Oldest Plant
ment, W89-02724 2A	SPLIT UNIV. (YUGOSLAVIA). FACULTY OF CIVIL ENGINEERING SCIENCES.	on the Mur,
SMITHSONIAN ENVIRONMENTAL	Identification of a Karst Hydrological System in the Dinaric Karst (Yugoslavia),	W89-03153 8C
RESEARCH CENTER, EDGEWATER, MD.	W89-03052 2F	SUPERIOR METAL PRODUCTS, LIMA, OH.
Estuarine Invertebrates and Fish: Sampling Design and Constraints for Long-Term Meas-	STADTWERKE MAINZ A.G. (GERMANY,	Application of Statistical Process Control to Wastewater Pretreatment,
urements of Population Dynamics, W89-02327 2L	F.R.).	W89-02404 5D
	Biochemical Testing of Groundwater, W89-03085 5A	CUDIO INC. MICCIOCALICA (ONTABIO)
SOCIETE GENERALE POUR LES TECHNIQUES NOUVELLES, SAINT-	CTAPRICCUES BALIBEREDAT	SYDLO, INC., MISSISSAUGA (ONTARIO). Potential for Anaerobic Treatment of High
QUENTIN-EN-YVELINES (FRANCE). Anaerobic Treatment of Molasse/Sugar Cane	STAEDTISCHES BAUREFERAT, SCHWEINFURT (GERMANY, F.R.).	Sulfur Wastewater in a Unique Upflow - Fixed Film - Suspended Growth Reactor,
Stillage with High Minerals,	Chemically Supported Oil and Grease Removal in Municipal Wastewater Treatment Plants,	W89-02290 5D
W89-02289 5D	W89-02813 5D	SYSTECH ENGINEERING, INC.,
Anaerobic Digestion of Chemical Industry Wastewaters Containing Toxic Compounds by	STANFORD UNIV., CA. DEPT. OF CIVIL	LAFAYETTE, CA.
Downflow Fixed Film Technology. W89-02291 5D	ENGINEERING. Coordination Chemistry at the Solid/Solution	Sensitivity of Meander Lake to Acid Deposition, W89-03110 5C
	Interface, W89-02642 5B	
SOIL CONSERVATION SERVICE, SALINA, KS.		SYSTEMS APPLICATIONS, INC., SAN RAFAEL, CA.
Water Conservation for More Crop Production in the Great Plains,	STATE UNIV. OF NEW YORK AT BUFFALO. DEPT. OF CIVIL ENGINEERING.	Rocky Mountain Acid Deposition Model As-
W89-02657 3F	Offline Bioregeneration of Granular Activated Carbon,	sessment: Evaluation of Mesoscale Acid Deposi- tion Models for Use in Complex Terrain,
SOUTH CAROLINA UNIV., COLUMBIA.	W89-03103 5D	W89-02969 5B
BELLE W. BARUCH INST. FOR MARINE BIOLOGY AND COASTAL RESEARCH.	STATE UNIV. OF NEW YORK AT STONY	TAHAL CONSULTING ENGINEERS LTD.,
Development, Management, and Analysis of a Long-Term Ecological Research Information	BROOK, MARINE SCIENCES RESEARCH	TEL-AVIV (ISRAEL), WATER RESOURCES AND ENVIRONMENTAL ENGINEERING
 Base: Example for Marine Macrobenthos, 	CENTER. Dynamics of Partially Mixed Estuaries,	DIV.
W89-02329 10D	W89-02683 2L	In Situ Biological Groundwater Denitrification: Concepts and Preliminary Field Tests,
Hydrodynamics of Estuaries, Volume I: Estua- rine Physics.	Little Holles,	W89-03097 5G
W89-02682 2L	W89-02689 2L	TATA CONSULTING ENGINEERS, BOMBAY
Hydrodynamics of Estuaries, Volume II: Estua-	Oceanography of Chesapeake Bay, W89-02693 2L	(INDIA).
rine Case Studies. W89-02692 2L		Uprating of Four Indian Hydro Plants, W89-03157 8C
	Sediment Transport Prediction in a Tidal Inlet Using a Numerical Model: Application to Stony	
SOUTH CAROLINA UNIV., COLUMBIA. DEPT. OF GEOLOGICAL SCIENCES. Glacio-Eustatic Sea-Level Control on Red Sea	Brook Harbor, Long Island, New York, USA,	TECHNICAL UNIV. OF DENMARK, LYNGBY. DEPT. OF SANITARY ENGINEERING.
Salinity,		Potential of Free-Living Ground Water Bacteria to Degrade Aromatic Hydrocarbons and Heter-
W89-03119 2L	River Estuary,	ocyclic Compounds,
SOUTH CENTRAL CONNECTICUT REGIONAL WATER AUTHORITY, NEW	W89-03194 2L	
HAVEN.	Comparison of Microbial Dynamics in Marine	
Evaluation of Sodium Aluminate as a Coagulan for Cost Savings at Water Treatment Plants	, bic Carbon Catabolism,	from an Oil-Contaminated Aquifer,
W89-02959 5F		W89-03149 5B

5B

TECHNICAL UNIV. OF DENMARK, LYNGBY. INST. FOR BIOTEKNOLOGI.

TECHNICAL UNIV. OF DENMARK, LYNGBY. INST. FOR BIOTEKNOLOGI. Training of Many Motels to Thermorphilic App	TETRA TECH, INC., ARLINGTON, VA. Water Quality Assessment of DOD Installations/Facilities in the Chesapeake Bay Region.	TRINITY COLL., DUBLIN (IRELAND). SCHOOL OF BOTANY.
Toxicity of Heavy Metals to Thermophilic Anaerobic Digestion, W89-02922 5D	Phase III Report. Volume 1 - Summary. W89-02953 5C	Responses of Four Irish Wetland Tree Species to Raised Soil Water Levels,
		W89-03128 2H
TECHNICAL UNIV. OF NOVA SCOTIA, HALIFAX, DEPT. OF CIVIL ENGINEERING. Phosphate Requirement for Anaerobic Fixed Film Treatment of Landfill Leachate,	Water Quality Assessment of DOD Installa- tions/Facilities in the Chesapeake Bay Region. Phase III Report. Volume 2 - Overall Approach, Findings and Recommendations.	TRONDHEIM UNIV. (NORWAY). LAB. OF BIOTECHNOLOGY. Growth and Phosphorous Status of Limnetic
W89-03132 5D	W89-02954 5C	Phytoplankton and Bacteria, W89-03244 2H
TECHNION - ISRAEL INST. OF TECH.,	THESSALONIKI UNIV., SALONIKA	W89-03244 2H
HAIFA. VYREDOX and NITREDOX Methods of In	(GREECE). ENVIRONMENTAL POLLUTION CONTROL LAB.	TSINGHUA UNIV., BEIJING (CHINA). DEPT. OF ENVIRONMENTAL ENGINEERING.
situ Treatment of Groundwater, W89-03091 5F	Comparative Study of Different Techniques for Nitrate Determination in Environmental Water Samples,	Modeling the Effects of Adsorbed Hydrolyzed Al(III)-Ions on Deep Bed Filtration,
Modelling of Flow and Transport Processes in Vyredox and Nitredox Subsurface Treatment	W89-03302 5A	W89-02796 5F
Plants, W89-03092 5F	THESSALONIKI UNIV., SALONIKA (GREECE). LAB. OF GENERAL AND	UMEA UNIV. (SWEDEN). DEPT. OF ECOLOGICAL BOTANY.
TECHNION - ISRAEL INST. OF TECH.,	INORGANIC CHEMICAL TECHNOLOGY. Separation of Heavy Metals from Effluents by	Radial Stem Growth of Coniferous Trees near Swedish Reservoirs,
HAIFA. SHERMAN CENTER FOR	Flotation,	W89-03142 6G
RESEARCH IN ENVIRONMENTAL AND WATER RESOURCES ENGINEERING.	W89-02803 5D	TAKE TAKE CHIEDEN DEPT OF
Movement and Survival of Bacteria in Porous Media.	TIANJIN INST. OF ENVIRONMENTAL PROTECTION AND SCIENCES (CHINA),	UMEA UNIV. (SWEDEN). DEPT. OF INORGANIC CHEMISTRY.
W89-03080 5B	Water Quality Problems and Control Strategies	Thermodynamic Calculations with Special Ref- erence to the Aqueous Aluminum System,
TECHNISCHE UNIV. BERLIN (GERMANY,	for the Water Supply of Tianjin City, W89-02794 5F	W89-02641 2K
F.R.). INST. FUER CHEMIEINGENIEURTECHNIK.	TOHOKU UNIV., SENDAI (JAPAN), DEPT.	TIME TOWN A CAN NATIONAL PARTY OF
Treatment of Filter Effluents from Dewatering	OF CIVIL ENGINEERING.	UNIT TENAGA NUKLEAR, BANGI (MALAYSIA).
of Sludges by a New High Performance Floccu- lation Reactor,	Anaerobic Biological Process for the Prevention of Noxious Odors in Pulp Manufacturing,	Application of Cs-137 Techniques to Problems
W89-02819 5D	W89-02928 5D	of Sediment Redistribution in Sungai Lui Repre- sentative Basin, Selangor, Malaysia: Part I.
TECHNISCHE UNIV. MUENCHEN,	TOKYO METROPOLITAN UNIV. (JAPAN).	W89-02712 2J
FREISING (GERMANY, F.R.). LEHRSTUHL	DEPT. OF INDUSTRIAL CHEMISTRY.	Pre-Feasibility on Streamflow Gauging Using
FUER OEKOLOGISCHE CHEMIE. Photodecomposition of Chlorophenols in Aque-	Xanthene Dye Chemiluminescence for Determi- nation of Free Chlorine in Water,	Radioisotope Tracer Method for Kemumbu Ag-
ous Medium in Presence of Hydrogen Peroxide,	W89-03183 7B	riculture Development Authority (KADA), W89-02713
W89-03200 5B	TONKIN AND TAYLOR LTD., AUCKLAND	W89-02/13 ZE
TECHNISCHE UNIV. MUENCHEN,	(NEW ZEALAND). Rehabilitation of the Kuratau Station in New	UNIVERSIDAD POLITECNICA DE MADRID
FREISING (GERMANY, F.R.). LEHRSTUHL FUER PFLANZENERNAHRUNG. Investigations on Leaching of Dicyandiamide	Zealand, W89-03154 8C	(SPAIN). ESCUELA TECNICA SUPERIOR DE INGENIEROS DE MONTES.
and its Decomposition in Flooded Soils (Unter-		Effects of Hydroelectric Scheme on Fluvia Ecosystems within the Spanish Pyrenees,
suchungen zur Auswaschung von Dicyandiamid und Dessen Abbau in Überstauten Boden),	TORONTO UNIV. (ONTARIO), DEPT. OF CIVIL ENGINEERING.	W89-03138 6G
W89-03043 5B	Utilization of Nitrite Oxidation Inhibition to Improve the Nitrogen Elimination Process,	UNIVERSITY COLL, LONDON (ENGLAND).
TECHNISCHE UNIV. MUENCHEN,	W89-02288 5D	DEPT. OF GEOGRAPHY.
GARCHING (GERMANY, F.R.). LEHRSTUHL FUER WASSERGUETEWIRTSCHAFT.	TORONTO UNIV. (ONTARIO). DEPT. OF	Phytokarst, Blue-green Algae and Limestone Weathering,
Heavy Metal Removal from Sewage Sludge:	GEOLOGY.	W89-02732 2K
Practical Experiences with Acid Treatment, W89-02818 5D	Determination of Tin in Environmental Samples by Graphite Furnace Atomic Absorption and Inductively Coupled Plasma-Mass Spectrome-	Recent Acidification of a Large Scottish Lock
TECHNISCHE UNIV. MUENCHEN,	try,	Located Partly within a National Nature Re serve and Site of Special Scientific Interest,
GARCHING (GERMANY, F.R.). LEHRSTUHL UND INST. FUER RADIOCHEMIE.	W89-03303 5A	W89-03125 50
Characterization of Colloids in Groundwater,	TORONTO UNIV. (ONTARIO), DEPT. OF	UNIVERSITY COLL. OF NORTH WALES.
W89-02998 2K	ZOOLOGY. Modification and Assessment of an Index of	MENAI BRIDGE, SCHOOL OF OCEAN
TECHNISCHE UNIV., MUNICH (GERMANY,	Biotic Integrity to Quantify Stream Quality in	SCIENCES.
F.R.). LEHRSTUHL FUER HYDROGEOLOGIE AND HYDROCHEMIE.	Southern Ontario, W89-03211 4C	Bacteria and Fungi, W89-02769 71
New System of Seepage Sampling for the Deter- mination of Volatile Organic Substances (Neues	TRANSVAAT APRETING	W 67-02707
System der Sickerwassergewinnung zur Bestim-	TRANSVAAL AFDELING NATUURBEWARING, PRETORIA (SOUTH	Plankton,
mung Leichtfluchtiger Organischer Spuren- stoffe),	AFRICA).	W89-02770 2I
W89-03047 5A	Conservation Management Options for Rivers, W89-02989 6A	UNIVERSITY COLL. OF WALES,
TENNESSEE VALLEY AUTHORITY, NORRIS.	TRENT POLYTECHNIC, NOTTINGHAM	ABERYSTWYTH. DEPT. OF GEOGRAPHY.
ENGINEERING LAB.	(ENGLAND).	Pipeflow and Pipe Erosion in the Maesnant Ex- perimental Catchment,
North Alabama Water Quality Assessment, Volume VIII - Water Quality Modeling,	Valley Excavation in the Yorkshire Dales Karst, W89-02742 2F	W89-02884 2I
W89-02702 5B		UNIVERSITY OF CENTRAL FLORIDA,
TENNESSEE VALLEY AUTHORITY, NORRIS,	TRENT UNIV., PETERBOROUGH (ONTARIO). TRENT AQUATIC RESEARCH	ORLANDO. DEPT. OF CHEMISTRY.
OFFICE OF NATURAL RESOURCES.	CENTRE.	Evaluation of Rain Chemistry Data for the John
Effects of Aeration and Minimum Flow En- hancement on the Biota of Norris Tailwater,	Scaled Chrysophytes (Chrysophyceae) as Indi- cators of pH in Sudbury, Ontario, Lakes,	F. Kennedy Space Center, Florida and the University of Central Florida, Orlando, Florida,
W89-02826 5G	W89-03227 5A	W89-02708 44

WINDSOR UNIV. (ONTARIO). DEPT. OF CIVIL ENGINEERING.

UNIVERSITY OF EAST ANGLIA, NORWICH (ENGLAND). SCHOOL OF	VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF CIVIL	Effect of Unsaturated/Saturated Zone Property Upon the Hydrogeochemical and Microbiologi-
ENVIRONMENTAL SCIENCES. River Dynamics, Flow Regime and Sediment	ENGINEERING. Dye-Sensitized Photochemical Reduction of	cal Processes Involved in the Migration and Attenuation of Landfill Leachate Components,
Transport, W89-02432 2J	PCBs, W89-03101 5D	W89-03087 5B
		WATERLOO UNIV. (ONTARIO), DEPT, OF
Flow Processes and River Channel Morpholo- gy.	VIRGINIA UNIV., CHARLOTTESVILLE. DEPT. OF ENVIRONMENTAL SCIENCES.	BIOLOGY.
gy, W89-02910 2J	Design of the Primary Pre-TRMM and TRMM	Growth, Fecundity, and Energy Stores of White Sucker (Catostomus commersoni) from Lakes
UNIVERSITY OF WYOMING RESEARCH CORP., LARAMIE. WESTERN RESEARCH	Ground Truth Site, W89-02971 7A	Containing Elevated Levels of Copper and Zinc, W89-03225 5C
INST. Evaluation of Baseline Conditions at Lease	VISVESVARAYA REGIONAL COLL, OF ENGINEERING, NAGPUR (INDIA), DEPT. OF	WATERLOO UNIV. (ONTARIO), DEPT. OF
Tract C-a, Rio Blanco County, Colorado, W89-02974 5B	CIVIL ENGINEERING. Extended Period Simulation of Water Systems –	GEOGRAPHY. Conflicting Objectives in Floodplain Manage-
UNOCAL CORP., BREA, CA. APPLIED	Direct Solution, W89-03106 5F	ment: Flood Damage Reduction Versus Herit- age Preservation,
TECHNOLOGY GROUP. Why Not Simplify Wastewater Compliance,		W89-02749 6F
W89-02397 SD	VIZGAZDALKODASI TUDOMANYOS KUTATO INTEZET, BUDAPEST (HUNGARY). Surface Water Hydrology,	WATERLOO UNIV. (ONTARIO). INST. FOR GROUND WATER RESEARCH.
UTAH STATE UNIV., LOGAN.	W89-02719 2E	Groundwater Contamination at a Landfill Sited
Biological Transformation and Detoxification of 7,12-Dimethylbenz(a)anthracene in Soil Systems,	Groundwater Microbiology: Problems and Bio-	on Fractured Carbonate and Shale, W89-03146 5B
W89-03161 5B	logical Treatment: State-of-the-Art Report,	
UTAH STATE UNIV., LOGAN, DEPT. OF	W89-03075 2F	WEIZMANN INST. OF SCIENCE, REHOVOTH (ISRAEL), DEPT, OF ISOTOPE
CIVIL AND ENVIRONMENTAL ENGINEERING.	WARREN SPRING LAB., STEVENAGE	RESEARCH.
In Situ Biological Treatment of Hazardous	(ENGLAND). Fate of Crude Oil at Sea and the Natural Disper-	Contaminated Aquifers are a Forgotten Compo- nent of the Global N2O Budget,
Waste-Contaminated Soils, W89-02923 5D	sion of Crude Oils and Water-in-Oil Emulsions: Results of Experiments Using a Laboratory Test	W89-03121 5B
ITAN INNV CALL LAVE CITY SCHOOL	Tank and Free-Floating Rings at Sea,	WESSEX WATER AUTHORITY, POOLE
OF MEDICINE.	W89-02944 5B	(ENGLAND). Development Control Procedures in England
Gastrointestinal Absorption of Soluble Uranium from Drinking Water,	Development and Field Use of a Snow Collec- tor for Acid Precipitation Studies,	and Wales,
W89-02957 5B	W89-02945 5B	W89-02748 6F
UTAH WATER RESEARCH LAB., LOGAN.	Comparison of Flow-Through and Towed	WESTERN AUSTRALIA UNIV., NEDLANDS.
National Surface Water Survey: National Stream Survey Phase I - Pilot Survey,	Fluorometers for Measuring Oil Concentrations	DEPT. OF CIVIL ENGINEERING. Djinnang II: A Facility to Study Mixing in
W89-02842 5G	in the Sea, W89-03329 5A	Stratified Waters,
UTRECHT RIJKSUNIVERSITEIT	WARMINGTON OF A TRUE TRUE TO THE TAXABLE TO THE TAX	W89-02701 7B
(NETHERLANDS). Effects of Cadmium on Consumption, Assimila-	WASHINGTON STATE UNIV., PULLMAN. Principles of Farm Irrigation System Design,	WESTERN WATER CONSULTANTS, INC., LARAMIE, WY.
tion and Biochemical Parameters of Daphnia	W89-02422 3F	Assessment of the Adequacy of the Ground-
magna: Possible Implications for Reproduction, W89-03289 5C	WASHINGTON UNIV., SEATTLE, DEPT. OF ATMOSPHERIC SCIENCES,	Water Monitoring System for Artificial Re- charge of Aquifers in the Los Angeles Area,
UTRECHT RIJKSUNIVERSITEIT	Soot from Arctic Haze: Radiative Effects on the	California, W89-02335 7A
(NETHERLANDS), INST. VOOR METEOROLOGIE EN OCEANOGRAFIE,	Arctic Snowpack, W89-02611 2C	
Estuarine Residence Times,	Studies of the Mechanisms and Rates with	WESTON (ROY F.), INC., ALBUQUERQUE, NM.
W89-02688 2L	which Nitrogen Species are Incorporated into	Hydrogeologic and Geochemical Aspects of
VERSAR, INC., COLUMBIA, MD.	Cloud Water and Precipitation, W89-02862 5B	Contaminant Transport at the Falls City, Texas UMTRA Site,
Summary of Maryland Stream pH and Alkalini- ty Data: Analysis of Its Application to Assessing		W89-02362 5B
the Impacts of Acidic Deposition, W89-02840 5C	WASHINGTON UNIV., SEATTLE, SCHOOL OF OCEANOGRAPHY.	WESTON (ROY F.), INC., WEST CHESTER,
	Biogenic Gases and the Oxidation and Reduc-	PA.
VERSAR, INC., SPRINGFIELD, VA. Waste Minimization Audit Report: Case Studies of Minimization of Mercury-Bearing Wastes at a	tion of Carbon in Amazon River and Floodplain Waters, W89-03247 2E	Land Treatment of Nitroguanidine Wastewater, W89-02293 5D
Mercury Cell Chloralkali Plant,		Optimizing Operation and Maintenance of
W89-02821 5E	Methane Cycling in the Sediments of Lake Washington,	Water Supply Wells, W89-02333 6B
Waste Minimization Audit Report: Case Studies	W89-03249 2H	
of Minimization of Solvent Wastes and Electro- plating Wastes at a DOD (Department of De-	WASSERWIRTSCHAFTSAMT MUENCHEN	Measurement of Groundwater Velocity with a Colorimetric Borehole Dilution Instrument,
fense) Installation, W89-02839 5D	(GERMANY, F.R.). Industrial Wastewater Pretreatment of a Dental-	W89-02345 7B
	Pharmaceutical Company, W89-02805 5D	Modeling of Polychlorinated Biphenyls in
VESI-HYDRO, HELSINKI (FINLAND). Aquifer Thermal Energy Storage in Finland,	W 07-02003	Vadose Zone,
W89-03082 4B	WATER RESEARCH CENTRE, MEDMENHAM (ENGLAND).	W89-02353 5B
VIRGINIA INST. OF MARINE SCIENCE,	Trace Metal Speciation in Sediments and Soils:	WINDSOR UNIV. (ONTARIO). DEPT. OF
GLOUCESTER POINT. Consequences of Dredging,	An Overview from a Water Industry Perspec- tive,	CIVIL ENGINEERING. Experimental Study of Flow in Settling Tanks,
W89-02700 2L	W89-02651 5B	W89-03107 8B

2L

WINDSOR UNIV. (ONTARIO), GREAT LAKES INST

WINDSOR UNIV. (ONTARIO). GREAT LAKES INST.	WORLD RESOURCES INST., WASHINGTON, DC.	WYOMING UNIV., LARAMIE. WATER RESOURCES RESEARCH INST.
Distribution of Contaminants in Clams and Sedi- ments from the Huron-Erie Corridor: II. Lead	West in Profile, W89-02631 6D	Fiscal Year 1986 Program Report (Wyoming
and Cadmium,		Water Research Center),
W89-03177 5B	New Water Policies for the West, W89-02639 6D	W89-02479 9D
WISCONSIN UNIV., MADISON. INST. FOR ENVIRONMENTAL STUDIES.	WUHAN INST. OF HYDROBIOLOGY	WYOMING WATER RESEARCH CENTER.
Effect of Climate on Development of Two	(CHINA).	LARAMIE,
Sphagnum Bogs in South-Central Wisconsin, W89-03293 2H	Fate and Effects of Xanthates in Laboratory Freshwater Systems,	Probability Distribution for Critical DO Loca-
	W89-03201 5G	tion in Streams,
WISCONSIN UNIVMADISON. WATER CHEMISTRY PROGRAM.	WYOMING UNIV., LARAMIE, DEPT. OF ATMOSPHERIC SCIENCE.	W89-03292 7B
Horizontal and Vertical Distribution of PCBs in Southern Lake Michigan Sediments and the Effect of Waukegan Harbor as a Point Source, W89-03170 SB	Estimate of Precipitation Enhancement Potential for the Duero Basin of Spain, W89-03306 3B	YORK UNIV., DOWNSVIEW (ONTARIO). FACULTY OF SCIENCE,
W89-03170 · 5B		Prediction of Phosphorus Release Rates from
WISCONSIN UNIVMILWAUKEE, DEPT. OF URBAN PLANNING.	WYOMING UNIV., LARAMIE. FISH PHYSIOLOGY AND TOXICOLOGY LAB.	Total and Reductant-Soluble Phosphorus in Anoxic Lake Sediments,
Water System Responses to Toxic Contamina- tion of Groundwater Supplies,	Effect of Long-Term Exposure to Acid, Alumi- num, and Low Calcium on Adult Brook Trout	W89-03210 2H
W89-02586 5F	(Salvelinus fontinalis): I. Survival, Growth, Fe- cundity, and Progeny Survival.	
WOLF, BLOCK, SCHORR AND SOLIS- COHEN, PHILADELPHIA, PA.	W89-03241 5C	ZHENGDING INST. OF HYDROGEOLOGY AND ENGINEERING GEOLOGY (CHINA).
Liability for Managing Hazardous Wastes: Past,	Effect of Long-Term Exposure to Acid, Alumi-	Groundwater in China,
Present and Future, W89-02398 6E	num, and Low Calcium on Adult Brook Trout (Salvelinus fontinalis): II. Vitellogenesis and Os-	W89-02371 2F
WOODS HOLE OCEANOGRAPHIC	moregulation, W89-03242 5C	Investigation into Mechanisms of Microbial Ef-
INSTITUTION, MA. COASTAL RESEARCH		fects on Iron and Manganese Transformations in
CENTER. 'Mussel Watch'Measurements of Chemical Pol-	Morphometric Changes in Gill Secondary La- mellae of Brook Trout (Salvelinus fontinalis)	Artificially Recharged Groundwater,
lutants in Bivalves as One Indicator of Coastal	after Long-Term Exposure to Acid and Alumi-	W89-03078 4B
Environmental Quality,	num,	
W89-02326 5A	W89-03243 5C	

ACCESSION NUMBER INDEX

W89-02287	5D	W89-02371	2F	W89-02455	2J	W89-02539 7C
W89-02288	5D	W89-02372	7B	W89-02456	2J	W89-02540 7C
W89-02289	5D	W89-02373	2F	W89-02457	2J	W89-02541 7C
W89-02290	5D	W89-02374	2F	W89-02458	2J	W89-02542 7C
W89-02291	5D	W89-02375	7B		2J	W89-02543 7C
W89-02292	5D	W89-02376	2F		21	W89-02544 7C
W89-02293	5D	W89-02377	2F		21	
W89-02294	5D	W89-02378	2F		2E	W89-02545 7C
		W89-02379				W89-02546 7C
W89-02295	5D		2F		7C	W89-02547 5B
W89-02296	5D	W89-02380	2F		5C	W89-02548 5G
W89-02297	5D	W89-02381	4B	W89-02465	4B	W89-02549 5B
W89-02298	5D	W89-02382	2F	W89-02466	10C	W89-02550 6A
W89-02299	5D	W89-02383	4B	W89-02467	10C	W89-02551 5B
W89-02300	5D	W89-02384	2F		4B	
W89-02301	5D	W89-02385	4B		2E	W89-02552 5C
W89-02302	7B	W89-02386	7B		9C	W89-02553 9D
						W89-02554 9D
W89-02303	5D	W89-02387	7A		9D	W89-02555 2K
W89-02304	5B	W89-02388	7B		4C	W89-02556 5B
W89-02305	5B	W89-02389	2F		5B	W89-02557 5B
W89-02306	5B	W89-02390	2F		6D	W89-02558 2H
W89-02307	5B	W89-02391	7A	W89-02475	3C	W89-02559 7C
W89-02308	5B	W89-02392	5G	W89-02476	6B	
W89-02309	5B	W89-02393	5G	W89-02477	9D	W89-02560 2F
W89-02310	5B	W89-02394	5D		2D	W89-02561 2F
W89-02311	5B	W89-02395	5D		9D	W89-02562 2H
W89-02312	2H	W89-02396	5D		7A	W89-02563 5B
						W89-02564 5B
W89-02313	2G	W89-02397	5D	W89-02481	2D	W89-02565 2E
W89-02314	5B	W89-02398	6E	W89-02482	4B	W89-02566 5B
W89-02315	5B	W89-02399	5E	W89-02483	4C	
W89-02316	5B	W89-02400	5G	W89-02484	5B	
W89-02317	5A	W89-02401	5D	W89-02485	5A	W89-02568 7B
W89-02318	5A	W89-02402	5D	W89-02486	5B	W89-02569 7C
W89-02319	5A	W89-02403	5D	W89-02487	5B	W89-02570 9C
W89-02320	7A	W89-02404	5D	W89-02488	4C	W89-02571 7C
W89-02321	5A	W89-02405	5D	W89-02489	2F	W89-02572 7C
						W89-02573 7C
W89-02322	2H	W89-02406	5D	W89-02490	7A	W89-02574 9C
W89-02323	5A	W89-02407	5D	W89-02491	2F	
W89-02324	7A	W89-02408	5D	W89-02492	2E	W89-02575 7C
W89-02325	5A	W89-02409	6A	W89-02493	7C	W89-02576 5B
W89-02326	5A	W89-02410	5G	W89-02494	7B	W89-02577 5B
W89-02327	2L	W89-02411	5D	W89-02495	7C	W89-02578 5B
W89-02328	5B	W89-02412	5F	W89-02496	2J	W89-02579 2H
W89-02329	10D	W89-02413	2H	W89-02497	7C	W89-02580 2K
W89-02330	5A	W89-02414		W89-02498	2F	W89-02581 7C
W89-02331	2F	W89-02415		W89-02499	2F	W89-02582 7C
W89-02332	4B	W89-02416		W89-02500	2E	W89-02583 2F
W89-02333		W89-02417		W89-02501		W89-02584 5B
	6B				2E	
W89-02334	5G	W89-02418		W89-02502	2E	W89-02585 5A
W89-02335	7A	W89-02419		W89-02503	7C	W89-02586 5F
W89-02336	4B	W89-02420	5A	W89-02504	5B	W89-02587 9D
W89-02337	4B	W89-02421	2A	W89-02505	2F	W89-02588 9D
W89-02338	5B	W89-02422	3F	W89-02506	6D	W89-02589 2F
W89-02339	4C	W89-02423	2H	W89-02507	2E	W89-02590 5B
W89-02340	4C	W89-02424		W89-02508	5B	W89-02591 5B
W89-02341	5C	W89-02425		W89-02509	2F	W89-02592 2E
W89-02342		W89-02426		W89-02510	7B	W89-02593 5B
W89-02342						
		W89-02427		W89-02511	7C	
W89-02344		W89-02428		W89-02512	2E	W89-02595 5B
W89-02345	7B	W89-02429		W89-02513	2F	W89-02596 4C
W89-02346		W89-02430		W89-02514	5B ·	W89-02597 4C
W89-02347		W89-02431	2J	W89-02515	7C	W89-02598 4C
W89-02348	5B	W89-02432	2J	W89-02516	5B	W89-02599 2K
W89-02349	2F	W89-02433		W89-02517	2F ·	W89-02600 7C
W89-02350		W89-02434		W89-02518	5B	W89-02601 4B
W89-02351		W89-02435		W89-02519	6G	W89-02602 2E
W89-02352		W89-02436				W89-02603 4B
				W89-02520	7B	
W89-02353		W89-02437		W89-02521	2F	W89-02604 2J
W89-02354		W89-02438		W89-02522	2F	W89-02605 5B
W89-02355		W89-02439		W89-02523	2J	W89-02606 2C
W89-02356		W89-02440		W89-02524	2D	W89-02607 2C
W89-02357	5G	W89-02441	8A	W89-02525	7C	W89-02608 2C
W89-02358		W89-02442		W89-02526	7C	W89-02609 2C
W89-02359		W89-02443		W89-02527	10C	W89-02610 2C
W89-02360		W89-02444		W89-02528	5B	W89-02611 2C
W89-02361		W89-02445		W89-02529	2L	W89-02612 2C
W89-02362		W89-02446		W89-02530	7C	W89-02613 2C
W89-02363		W89-02447		W89-02531	7C	W89-02614 7B
W89-02364		W89-02448		W89-02532	7C	W89-02615 2C
W89-02365		W89-02449		W89-02533	7C	W89-02616 2C
W89-02366	2F	W89-02450		W89-02534	7C	W89-02617 2C
W89-02367	2F	W89-02451	l 2J	W89-02535	7C	W89-02618 7B
W89-02368		W89-02452	2 2J	W89-02536	7C	W89-02619 7C
W89-02369		W89-02453		W89-02537	7C	W89-02620 7B
W89-02370		W89-02454		W89-02538	7C	W89-02621 7B
1107-023/0		11 07-02-13		11 07-02330		1107 C2021 1D

ACCESSION NUMBER INDEX

W89-02622

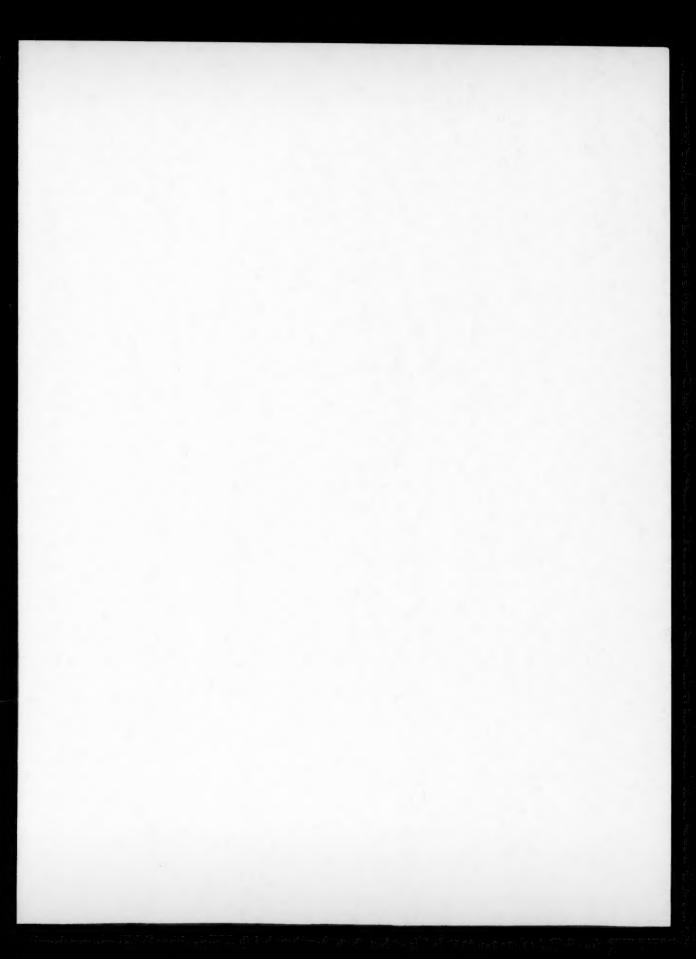
W89-02622	7C	W89-02706 5D	W89-02790 5F	W89-02874 6G
W89-02623	7B	W89-02707 5G	W89-02791 5G	W89-02875 4C
W89-02624	7B	W89-02708 4C	W89-02792 5F	W89-02876 5B
W89-02625	2C	W89-02709 2H	W89-02793 5F	W89-02877 2H
W89-02626	7C	W89-02710 2H	W89-02794 5F	W89-02878 4C
W89-02627	2C	W89-02711 5D	W89-02795 5F	W89-02879 4C
W89-02628	2C	W89-02712 2J	W89-02796 5F W89-02797 5F	W89-02880 2E
W89-02629	2C	W89-02713 2E W89-02714 8F	W89-02797 5F W89-02798 5F	W89-02881 2E W89-02882 2E
W89-02630 W89-02631	6D 6D	W89-02715 6G	W89-02799 5F	W89-02883 2G
W89-02632	6D	W89-02716 4A	W89-02800 5D	W89-02884 2E
W89-02633	6D	W89-02717 2A	W89-02801 5G	W89-02885 2E
W89-02634	6D	W89-02718 2A	W89-02802 5D	W89-02886 2J
W89-02635	6D	W89-02719 2E	W89-02803 5D	W89-02887 2E
W89-02636	6D	W89-02720 2F	W89-02804 5D	W89-02888 2E
W89-02637	6D	W89-02721 5G	W89-02805 5D	W89-02889 2E
W89-02638	6D	W89-02722 2C	W89-02806 5D	W89-02890 2G
W89-02639	6D	W89-02723 2J	W89-02807 5D	W89-02891 2G
W89-02640	5B	W89-02724 2A	W89-02808 5D W89-02809 5D	W89-02892 2J
W89-02641	2K	W89-02725 2A W89-02726 2A	W89-02810 5D	W89-02893 2J
W89-02642 W89-02643	5B 5B	W89-02727 2A	W89-02811 5D	W89-02894 2J
W89-02644	5B	W89-02728 2F	W89-02812 5D	W89-02895 2J
W89-02645	5B	W89-02729 2F	W89-02813 5D	W89-02896 2J
W89-02646	7B	W89-02730 2K	W89-02814 5D	W89-02897 2J
W89-02647	7B	W89-02731 2K	W89-02815 5D	W89-02898 2J
W89-02648	5A	W89-02732 2K	W89-02816 5D	W89-02899 2J
W89-02649	5B	W89-02733 2F	W89-02817 5D	W89-02900 2K W89-02901 2K
W89-02650	5B	W89-02734 2F	W89-02818 5D	W89-02901 2K W89-02902 2E
W89-02651	5B	W89-02735 2A	W89-02819 5D	W89-02902 2E W89-02903 2E
W89-02652	5B	W89-02736 2F	W89-02820 5D	W89-02904 2J
W89-02653	5D	W89-02737 2F	W89-02821 5E	W89-02905 2J
W89-02654	3F	W89-02738 2J	W89-02822 5B	W89-02906 2J
W89-02655	3F	W89-02739 2F	W89-02823 4C	W89-02907 2J
W89-02656	5B	W89-02740 2J	W89-02824 7C	W89-02908 2J
W89-02657	3F	W89-02741 2F W89-02742 2F	W89-02825 4D W89-02826 5G	W89-02909 2J
W89-02658 W89-02659	3F 6D	W89-02743 4A	W89-02827 5B	W89-02910 2J
W89-02660		W89-02744 4A	W89-02828 5D	W89-02911 2J
W89-02661	3F	W89-02745 6F	W89-02829 5G	W89-02912 2E
W89-02662		W89-02746 4A	W89-02830 2B	W89-02913 2E
W89-02663		W89-02747 6E	W89-02831 2E	W89-02914 5D
W89-02664		W89-02748 6F	W89-02832 6E	W89-02915 5D
W89-02665		W89-02749 6F	W89-02833 5G	W89-02916 5G
W89-02666		W89-02750 6F	W89-02834 5E	W89-02917 5D
W89-02667		W89-02751 4A	W89-02835 3F	W89-02918 5D
W89-02668	5B	W89-02752 6E	W89-02836 5F	W89-02919 5D
W89-02669	5G	W89-02753 6F	W89-02837 3F	W89-02920 5D
W89-02670		W89-02754 6F	W89-02838 5D	W89-02921 5D
W89-02671		W89-02755 6F	W89-02839 5D	W89-02922 5D
W89-02672		W89-02756 6B	W89-02840 5C	W89-02923 5D
W89-02673		W89-02757 2E	W89-02841 5G	W89-02924 5D
W89-02674		W89-02758 6E	W89-02842 5G	W89-02925 5D W89-02926 5D
W89-02675 W89-02676		W89-02759 7B W89-02760 7B	W89-02843 5B W89-02844 5G	W89-02926 5D W89-02927 5D
W89-02677		W89-02760 7B W89-02761 7B	W89-02845 5D	W89-02928 5D
W89-02678		W89-02762 7B	W89-02846 5B	W89-02929 5D
W89-02679		W89-02763 2L	W89-02847 2J	W89-02930 5D
W89-02680		W89-02764 2L	W89-02848 8A	W89-02931 5D
W89-02681		W89-02765 7B	W89-02849 3A	W89-02932 2H
W89-02682		W89-02766 2L	W89-02850 2F	W89-02933 5D
W89-02683		W89-02767 2L	W89-02851 8D	W89-02934 4D
W89-0268		W89-02768 7B	W89-02852 2H	W89-02935 5D
W89-0268		W89-02769 7B	W89-02853 2F	W89-02936 5C
W89-0268		W89-02770 2L	W89-02854 7C	W89-02937 8A
W89-0268		W89-02771 7B	W89-02855 5D	W89-02938 5B
W89-0268		W89-02772 2L	W89-02856 5D	W89-02939 6F
W89-0268		W89-02773 5C	W89-02857 5B	W89-02940 6G
W89-0269		W89-02774 5B	W89-02858 5C	W89-02941 5F
W89-0269		W89-02775 2H	W89-02859 8A	W89-02942 5F
W89-0269		W89-02776 5C	W89-02860 5G	W89-02943 5F
W89-0269 W89-0269		W89-02777 7B W89-02778 5G	W89-02861 4C W89-02862 5B	W89-02944 5B W89-02945 5B
W89-0269 W89-0269		W89-02778 3G W89-02779 2J	W89-02862 5B W89-02863 5F	W89-02945 3B W89-02946 2H
W89-0269		W89-02779 23 W89-02780 2J	W89-02863 5F W89-02864 5C	W89-02946 2H W89-02947 5D
W89-0269		W89-02780 25 W89-02781 8F	W89-02865 6B	W89-02947 5D W89-02948 5D
W89-0269		W89-02782 3A	W89-02866 5C	W89-02949 5D
W89-0269		W89-02783 2J	W89-02867 5B	W89-02950 5F
W89-0270		W89-02784 5B	W89-02868 5C	W89-02951 5F
W89-0270		W89-02785 5B	W89-02869 7B	W89-02952 5E
W89-0270		W89-02786 5D	W89-02870 5B	W89-02953 5C
W89-0270		W89-02787 2B	W89-02871 5E	W89-02954 5C
W89-0270		W89-02788 5B	W89-02872 5D	W89-02955 5F
W89-0270		W89-02789 5F	W89-02873 5B	W89-02956 5A

W89-02957	5B	W89-03041 5F	W89-03125 5C	W89-03209 2H
W89-02958	7B	W89-03042 5C	W89-03126 2K	W89-03210 2H
W89-02959	5F	W89-03043 5B	W89-03127 6F	W89-03211 4C
W89-02960	5D	W89-03044 5F	W89-03128 2H	W89-03212 5C
W89-02961	5D	W89-03045 5D	W89-03129 7A	W89-03213 5C
W89-02962	5D	W89-03046 5A	W89-03130 5B	W89-03214 2H
		W89-03047 5A	W89-03131 5C	
W89-02963	5G		W89-03132 5D	W89-03215 2H
W89-02964	5E	W89-03048 5A		W89-03216 2H
W89-02965	5C	W89-03049 2B	W89-03133 2J	W89-03217 7B
W89-02966	5G	W89-03050 2F	W89-03134 4A	W89-03218 2H
W89-02967	5B	W89-03051 2F	W89-03135 5B	W89-03219 2H
W89-02968	2B	W89-03052 2F	W89-03136 5B	W89-03220 5B
W89-02969	5B	W89-03053 2J	W89-03137 8G	W89-03221 2H
W89-02970	5F	W89-03054 2B	W89-03138 6G	W89-03222 2H
W89-02971	7A	W89-03055 2L	W89-03139 6G	
W89-02972	5B	W89-03056 5C	W89-03140 6G	W89-03223 2H
		W89-03057 5C	W89-03141 4A	W89-03224 5B
W89-02973	2J			W89-03225 5C
W89-02974	5B	W89-03058 5C	W89-03142 6G	W89-03226 5C
W89-02975	5D	W89-03059 2L	W89-03143 6G	W89-03227 5A
W89-02976	5F	W89-03060 5F	W89-03144 5G	W89-03228 5C
W89-02977	5E	W89-03061 5E	W89-03145 5G	W89-03229 2H
W89-02978	5E	W89-03062 2H	W89-03146 5B	W89-03230 2H
W89-02979	5G	W89-03063 2A	W89-03147 5B	
W89-02980	5G	W89-03064 5B	W89-03148 2F	W89-03231 5C
W89-02981	5A	W89-03065 5G	W89-03149 5B	W89-03232 2H
W89-02982	2H	W89-03066 5G	W89-03150 2G	W89-03233 2L
		W89-03067 5A	W89-03151 2G	W89-03234 5C
W89-02983	5G		W89-03152 8C	W89-03235 5C
W89-02984	5G	W89-03068 5A		W89-03236 5C
W89-02985	2H	W89-03069 8C	W89-03153 8C	W89-03237 5C
W89-02986	2H	W89-03070 8C	W89-03154 8C	
W89-02987	2H	W89-03071 8C	W89-03155 8C	W89-03238 5C
W89-02988	4C	W89-03072 8C	W89-03156 8C	W89-03239 5C
W89-02989	6A	W89-03073 8C	W89-03157 8C	W89-03240 5C
W89-02990	2H	W89-03074 8G	W89-03158 8F	W89-03241 5C
W89-02991	7B	W89-03075 2F	W89-03159 5C	W89-03242 5C
W89-02992	6E	W89-03076 5B	W89-03160 5D	W89-03243 5C
		W89-03077 5B	W89-03161 5B	W89-03244 2H
W89-02993	2H			W89-03245 2H
W89-02994		W89-03078 4B		W89-03246 5C
W89-02995		W89-03079 5B	W89-03163 5D	
W89-02996		W89-03080 5B	W89-03164 5D	
W89-02997	5B	W89-03081 5B	W89-03165 5D	W89-03248 2H
W89-02998	2K	W89-03082 4B	W89-03166 5F	W89-03249 2H
W89-02999	5B	W89-03083 5G	W89-03167 5D	W89-03250 2H
W89-03000	5B	W89-03084 2F	W89-03168 5B	W89-03251 7B
W89-03001		W89-03085 5A	W89-03169 2H	W89-03252 7B
W89-03002		W89-03086 5B	W89-03170 5B	W89-03253 2K
		W89-03087 5B	W89-03171 2H	W89-03254 2H
W89-03003		W89-03088 5F	W89-03172 5C	W89-03255 2H
W89-03004				W89-03256 2H
W89-03005		W89-03089 2F	W89-03173 4A	
W89-03006		W89-03090 5F	W89-03174 7A	W89-03257 2H
W89-03007	7 2F	W89-03091 5F	W89-03175 5B	W89-03258 2H
W89-03008	3 5G	W89-03092 5F	W89-03176 2H	W89-03259 2H
W89-03009	9 2F	W89-03093 5F	W89-03177 5B	W89-03260 2H
W89-03010	7B	W89-03094 5F	W89-03178 2H	W89-03261 2H
W89-03011	1 2F	W89-03095 5G	W89-03179 2H	W89-03262 2H
W89-03012		W89-03096 5F	W89-03180 5A	W89-03263 2H
W89-0301		W89-03097 5G	W89-03181 7B	W89-03264 2H
				W89-03265 2H
W89-03014		W89-03098 5D W89-03099 5D	W89-03182 7B W89-03183 7B	W89-03266 2H
W89-0301:				
W89-0301		W89-03100 5G	W89-03184 2L	W89-03267 2H
W89-0301		W89-03101 5D	W89-03185 2J	W89-03268 2H
W89-0301		W89-03102 5E	W89-03186 2J	W89-03269 2H
W89-0301	9 6G	W89-03103 5D	W89-03187 2J	W89-03270 2H
W89-0302	0 2F	W89-03104 5D	W89-03188 2L	W89-03271 2E
W89-0302		W89-03105 7A	W89-03189 2L	W89-03272 2A
W89-0302		W89-03106 5F	W89-03190 5B	W89-03273 2B
W89-0302		W89-03107 8B	W89-03191 2L	W89-03274 2B
W89-0302		W89-03107 8B	W89-03192 2L	W89-03275 5B
W89-0302		W89-03109 5F	W89-03193 2J	W89-03276 2L
W89-0302 W89-0302				W89-03277 2L
		W89-03110 5C	W89-03194 2L	
W89-0302		W89-03111 5G	W89-03195 5B	
W89-0302		W89-03112 2K	W89-03196 5B	W89-03279 7A
W89-0302		W89-03113 7A	W89-03197 5B	W89-03280 5D
W89-0303	30 2F	W89-03114 5D	W89-03198 5B	W89-03281 5F
W89-0303		W89-03115 5D	W89-03199 5B	W89-03282 5E
W89-0303		W89-03116 5D	W89-03200 5B	W89-03283 5D
W89-0303		W89-03117 7A	W89-03201 5G	W89-03284 5D
		W89-03118 2H	W89-03202 5C	W89-03285 5F
W89-0303				
W89-0303		W89-03119 2L	W89-03203 5C	
W89-0303		W89-03120 5B	W89-03204 5C	W89-03287 5A
W89-0303		W89-03121 5B	W89-03205 5C	W89-03288 5C
W89-0303		W89-03122 2E	W89-03206 5C	W89-03289 5C
W89-0303	39 5B	W89-03123 2H	W89-03207 5C	W89-03290 5C
W89-030	40 5B	W89-03124 2H	W89-03208 5C	W89-03291 2H

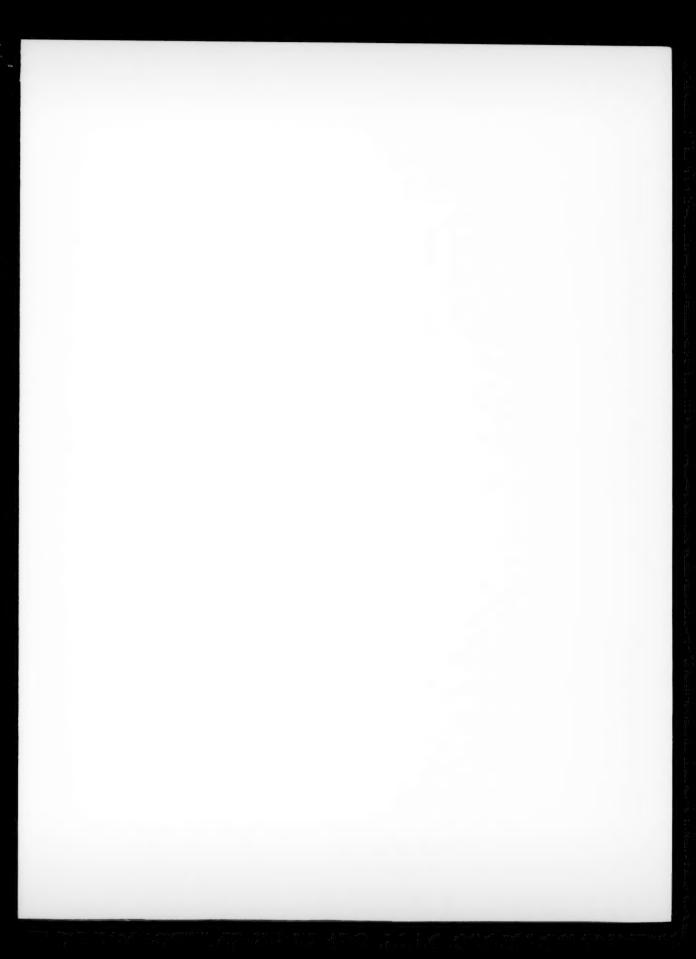
ACCESSION NUMBER INDEX

W89-03292

W89-03292	7B	W89-03303	5A	W89-03314	5C	W89-03325	5D
W89-03293	2H	W89-03304	5B	W89-03315	5C	W89-03326	5D
W89-03294	2H	W89-03305	2B	W89-03316	5C	W89-03327	5D
W89-03295	2H	W89-03306	3B	W89-03317	5B	W89-03328	5D
W89-03296	5C	W89-03307	2B	W89-03318	5B		
W89-03297	5B	W89-03308	2D	W89-03319	5F		5A
W89-03298	5C	W89-03309	5D	W89-03320	5B	W89-03330	2E
W89-03299	5B	W89-03310	5C	W89-03321		W89-03331	2C
W89-03300	5C	W89-03311	2K	W89-03322	5D	W89-03332	5B
W89-03301	5A	W89-03312	5C	W89-03323	2L	W89-03333	5C
W89-03302	5A	W89-03313	5C	W89-03324	5C	W89-03334	4A







Subject Fields

- NATURE OF WATER
- WATER CYCLE
- WATER SUPPLY AUGMENTATION 3 AND CONSERVATION
- WATER QUANTITY MANAGEMENT 4 AND CONTROL
- WATER QUALITY MANAGEMENT AND PROTECTION
- WATER RESOURCES PLANNING
- RESOURCES DATA
- **ENGINEERING WORKS** 8
- MANPOWER, GRANTS, AND 9 **FACILITIES**
- SCIENTIFIC AND TECHNICAL 10 INFORMATION

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A22-A25 49.95	E09 28.00	D09 425	T09 925	
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	E11 33.50	D11 525	T11 1,125	
	E12 36.50	D12 575	T12 1,225	
	E13 39.00	D13 625	T13 1,325	
	E14 42.50	D14 675	T14 1,425	
D. LE-L-J	E15 46.00	D15 725	T15 1,525	
Published	E16 50.50	D16 775	T16 1,625	
Searches &	E17 54.50	D17 825	T17 1,725	
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SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSSION NUMBER INDEX

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